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BATTERY B, SECOND FIELD ARTILLERY ON MARCH 20, 1931, FLEW 76 MILES, WENT INTO POSITION AND FIRED, ALL IN ONE HOUR AND TWELVE MINUTES (SEE PAGE 245)

THE FIELD ARTILLERY JOURNAL

VOL. XXI. MAY-JUNE, 1931 No. 3

TRUCK-DRAWN ARTILLERY

BY CAPT. M. R. COX, F.A., INSTRUCTOR, THE FIELD ARTILLERY SCHOOL

HOW is the Field Artillery to keep entrucked Infantry in sight on strategic moves? What can it do about keeping up in the longer tactical displacements? In view of the demand for mobility and the developments in motor transport, time will usually be saved by entrucking Infantry for movements in excess of sixteen miles. This limit might conceivably be reduced to ten miles through improvements in truck bodies that will permit the men to mount, several at a time over the sides, instead of clambering aboard one at a time over the tail gate. The above distances are within the normal moves of divisional and corps reserves.

Obviously the artillery teams and tractors can not go as fast on the roads as trucks. The logical solution appears to be: load the Artillerymen in trucks also, hitch the guns on behind and hit the roads with the doughboys. When the Infantry dismounts to fight, the artillery must do likewise; unless it can be provided with trucks as capable of hauling the guns across the battlefield as they are of transporting them between battlefields. This development in trucks is altogether possible, but, so far no wheeled vehicle has come to light which has the cross-country ability of a team or a crawler type tractor. Until this ideal in artillery transport is realized, the artillery had better take its teams and tractors along.

The problem of transporting the teams by truck depends entirely upon the availability of sufficient trucks to accommodate the animals. Arrangements for loading the teams aboard the trucks, and for getting them on the ground again can be, and have been, improvised on the spot. If it has to be done it will be done.

Considerable experimentation has been carried on by the Cavalry, Field Artillery, and Quartermaster Corps leading to the development of ramps and special bodies to facilitate the transport of animals by truck. It is enough to state that some

workable schemes have been perfected, so that if the trucks are at hand the horses can be entrucked.

The same may be said of schemes for loading tractors and guns aboard trucks.

However, it is entirely beyond all reasonable possibilities to expect that enough trucks will always be at hand in the division, or corps, to transport every team, carriage, gun and tractor of the artillery, with its ammunition, wire, and other impedimenta. The drain on motor transportation would be most serious when the Infantry has to be moved, which is also the time that the Field Artillery should be getting under way. The probable result will be, that the Infantry will crowd into as few trucks as possible and that the Field Artillery will get the remainder.

Any artillery carriage that can be towed on its own wheels behind a truck, makes available just that much more space in some truck for other essential equipment; which means better artillery support and more of it. In any event, if the guns can be trailed behind the trucks the movement will be greatly facilitated in that no special ramps for entrucking the guns need to be provided; trucks of any body width may be used; a truck that would be overloaded in carrying the gun with its crew and ammunition, could trail the gun and transport a body load without exceeding its capacity. Therefore the Field Artillery may be transported by the standard cargo trucks of the division and corps trains—just the same as the Infantry.

The present guns and howitzers cannot be towed on their own wheels for any great distance at speeds above ten miles per hour without seriously impairing their usefulness. Roller or ball bearings are required for higher speeds, and the pieces must be cushioned from road shocks which become more severe as speed increases.

Rather extensive redesign and modification would be required if these features were incorporated in the present weapons. And we have far too many of these ever to think of not using them, in some manner, in their present state. The 75 mm. guns which make up the bulk of our armament (there are about 4800 on hand) will doubtless be the principal artillery weapon with which the Army must enter, and probably end any conflict that

may face us in any but the very distant future. Although new weapons such as the T-3, have increased range and are designed for rapid transit on their own wheels, with all-around traverse and high-angle of fire possibilities, they cannot replace the present armament, even in the organizations of the Regular Army, for several years. Financial and economic restrictions are certain to prohibit the wholesale peace-time production of new guns in sufficient number to equip the National Guard. The National Guard, forming about 4/5 of our first phase troops, is rapidly motorizing its artillery. This transition is unhapilly being accomplished with 1918 model motor vehicles. But these cannot last forever, in spite of evident faith in that miracle. So when replacements are made of prime movers for the guns, they will be modern in type and speed. But the guns themselves will not have been worn out; they cannot be ruthlessly destroyed nor relegated to parks and public squares; they must be used, and must be moved in active operations by modern vehicles capable of towing them faster than they can safely go on their own wheels.

With these things in mind, Capt. H. E. Minton, Ord. Dept. and writer began the development of a trailer for the 15 mm. guns in February, 1929. It was decided that in order to meet the conditions of service, such a trailer should have the following characteristics: (1) lightness, (2) stability, (3) simplicity in design and construction, (4) ease in mounting and dismounting the piece, (5) security for the piece when mounted, (6) all manipulations without tools of any kind, (7) protection of the piece against road shocks, (8) ground clearance of at least 12 inches, (9) capability of carrying ammunition, or other cargo.

There being no funds at hand for such experimentation at the time, it became necessary to interest someone with the facilities and willingness to undertake "wildcat drilling." Some very pleasant and advantageous contacts had been made with builders and operators of motor vehicles through the visits of the Advanced Motor Class from the Field Artillery School. Among these is the Wichita Motor Company, of Wichita Falls, Texas, builders of Wichita Trucks, a rugged, heavy duty job designed especially for oil field service. The company also makes trailers

and oil well fishing tools, and is continually experimenting with drill rigs and other oil field equipment. The plant manager and the shop superintendent are enthusiastic about anything new in the way of transport. Also, the son of the company's president is an officer in the National Guard. We had been able, at one time, to render this young man a slight service in connection with a pair of field glasses that required cleaning and adjustment.

So, for one reason or another, the Wichita Motor Company agreed to build a trailer for us. They undertook the job without promise of payment or hope of reward, other than a possible development of something that might be of use in their business of supplying equipment to oil field operators.

The first model, as constructed by the Wichita company, is shown in figure 1 and figure 2. A French 75 m/m gun was loaded on this trailer at Wichita Falls, Texas, and towed behind a Wichita two-wheel-drive truck to Fort Sill. A maximum speed of 42 miles per hour was attained without difficulty. The rig demonstrated roadability, and there was no damage to the gun, although springs are not included in the design. Pneumatic tires inflated to the pressure recommended for normal use furnished enough resiliency for complete protection against road shocks. An average speed of 28 miles per hour was maintained for the 71 miles from Wichita Falls to Fort Sill. Of this distance, 52 miles is dirt road which, at the time, was wet from recent rains and badly rutted from traffic.

Not being satisfied with the original arrangement provided for securing the piece, the "outrigger" effect of the side channels, and the fact that five men were needed to load the gun on the trailer, a complete redesign was undertaken. The trailer was rebuilt in the Post Ordnance Shop at Fort Sill, with the valuable assistance of Mr. H. E. Larsen, civilian shop foreman.

Figures 3 and 4 show the trailer, as rebuilt, in position to receive a gun. The blocks seen behind the wheels prevent the trailer from rolling backward as the gun is pushed up the ramp channels. When the gun is in place, and secured by the turnbuckles, these blocks are placed in front of the wheels as additional security against movement.

The trailer with its load secured and coupled to a tractor by means of the lunette on the gun trail is shown in figure 5. No tools other than human hands are needed to manipulate all fastenings. When the gun is backed up the ramps, which may be done by the gun crew, the tractor, or the truck, and the gun wheels come up against the curved stops at the ends of the ramp channels, the front end of the trailer tongue automatically rises up in place against the gun trail. The side, or ramp channels, may then be swung in against the trail and all secured in place without lifting anything.

These pictures show how the requirements of *lightness, simplicity, ease in mounting and securing the gun* were met. The three requirements of *stability, cushioning the load against road shocks* and *ground clearance* are correlated. If springs are used to cushion the load, either ground clearance or stability must suffer. Springs are unnecessary with pneumatic tires and a load of the nature to be carried. Excellent stability is obtained by placing the trailer wheels at a wider tread than the gun wheels. The wheels of this trailer will track with the outside tires of a dual-tired truck, which presents some advantages in addition to stability, especially in cross-country travel. Hereafter, we may expect a majority of the heavy duty trucks placed in production to come equipped with dual tires due to the reduction in tire wear, increased carrying capacity obtainable, factor of safety against delays from tire failures, and the lower first cost in tire equipment.[1]

The use, at all, of pneumatic tires on military vehicles intended for service in the battle zone brings up some pertinent questions. We desire to get the benefit of their resilience and traction, as well as the decrease in unit ground pressures that they insure in comparison with solid tires. Yet the artillery can scarcely afford the delays incident to punctures; a gun reported out of action, or seriously delayed because of a flat tire would cause many famous artillerymen to turn in their graves.

However, modern heavy duty truck tires are practically impervious

[1]A 42″ × 9″ standard heavy duty truck tire, costing $169.00, will carry 5,000 pounds. Two 36″ × 6″ heavy duty truck tires each with a capacity of 2,500 pounds, or 5,000 pounds for the two, will cost $103.60 for the pair, difference of $65.40. Two tires provide the same carrying capacity at 60% of the cost.

to anything they run over. Direct hits by flying shell fragments, or small arms projectiles, would doubtless be more destructive to pneumatic than to hard tires. Our old friend "probabilities" enters the game at this point; most of us can count on our fingers the guns that have been seen out of action because of serious damage to the wheels from direct hits. Also, the effects of direct hits can be minimized and all the advantages of pneumatic tires retained, excepting a slight difference in resiliency, by substituting for air under pressure some other filling medium that will not escape. Such a filler made of sponge rubber is on the market, also one composed of ground cork and rubber can be had commercially. One of these may be forced into the inner tube while in liquid form where it congeals, the other is supplied in solid form, in segments, for filling the casing.

If the trailers can be built with *capacity to carry ammunition and other cargo* when not used to transport the piece, several of them may be towed in tandem behind a tractor and used to bring ammunition to the gun positions over terrain that would reduce the trucks to tractor speed, or that would be impassable for trucks. Meanwhile the trucks are bringing up ammunition from the rear over more passable routes, depositing it as near as possible to the gun positions. Even though the trucks could get to the gun positions, it might be better in many situations to use tractors and trailers for transportation in close proximity to the guns, because they do not present such large targets, and they could choose concealed routes that the trucks could not attempt due to their height, width or tractive ability.

This feature of capacity for cargo had not been added to the trailer when the pictures presented here were taken. All that will be required is a frame with collapsible sides and ends; these to fold down flat out of the way when a gun is mounted on the trailer. It is expected that, when constructed, these frames will hold 15 boxes, or 60 rounds of 75 m/m ammunition.

Figure 7 is a gun section ready for the road, and in figure 6 the section "full speed ahead" on the road. Of course, the Standard "B" truck shown in the illustrations is not entirely suitable transportation; it does not meet the new demand in speed, nor in cross-country mobility.

With modern equipment, the gun section would consist of:

1—5-ton, six wheel, four-wheel-drive, truck, capacity	10,000 lbs.
1—Caterpillar Fifteen, or similar tractor	5,100 lbs.
10—Men and equipment (1)	1,700 lbs.
80—Rounds of boxed ammunition	2,370 lbs.
Body allowance	1,000 lbs.
	10,170 lbs.

With the gun section, as outlined above, for a nucleus around which complete organizations may be erected, *truck-drawn artillery* comes to life, This type of artillery, as distinguished from other motorized types, viz., tractor-drawn and portée, has been recognized heretofore principally as an item in academic descriptions and classifications of artillery types, rather than as a reality. Failure to give truck-drawn artillery more concrete form has been due, in great measure, to a combination of circumstances that up to the present time have operated to prevent practical progress in developing the idea. The chief draw-backs have been:

(1) Great quantities of war-time trucks on hand which could not serve as prime movers for artillery, particularly in cross-country travel and for wet-weather work on dirt roads. they were, also, incapable of attaining the road speeds which truck-drawn artillery must have in order to justify its existence.

(2) No active artillery units in the Regular Army that could be extracted from their assigned places and converted into truck-drawn types without seriously disrupting the general plan. Few National Guard units willing to give up the romantic glamour of the stables and take to the garage.

(3) Guns which could not be towed on their own wheels at the speeds required of truck-drawn artillery, even though the trucks were made available.

(4) Lack of confidence in the ability of commercial trucks to meet the combined road and cross-country requirements demanded of prime movers for field guns.

It is evident that these objections to active development of this new type of artillery have today either disappeared entirely, or are rapidly decreasing in potency.

The Field Artillery is no longer overburdened with obsolete trucks; in fact it is handicapped to a stultifying degree by the

(1) 1 sergeant, chief of section; 1 corporal, gunner; 1 truck driver, 1 tractor driver; 6 cannoneers.

lack of trucks. The old vehicles having been worn out and salvaged, leaving motorized units in a position similar to that of the colored brother whose shoes were so far gone that he philosophically resigned himself to "just a sittin' 'round waitin' fo' a pair o' shoes or sumpin." However, the replacements in motor vehicles that have been made are modern, speedy, powerful and capable of pulling the guns. Tests along that line are being conducted.

The formation of the mechanized force, the production and issue of the 105 m/m howitzer, and the decision of the Militia Bureau to encourage motorization of National Guard artillery, have all operated to create units ready for experimentation with trucks as prime movers.

A means is here presented for towing the present armament at high speeds; the Ordnance Department has developed a similar agency; and trucks are being produced commercially that inspire confidence because of demonstrated performances.[1]

Whether or not truck-drawn types can ever completely replace horse-drawn light artillery, or tractor-drawn medium artillery in the division, is a question still consigned to the future. It is becoming more and more evident that the horse should be conserved for use where it has been conclusively demonstrated that he alone can function. This conservation of animal resources is most effectively attained by relieving the horse of heavy draft duty in the zone of action. For it is here that the horse is an almost certain casualty, especially when teamed; he has a much better chance as an individual. As an individual he performs some essential services in a manner that have, so far, not been duplicated through any other agency. Animal casualties at the front are not due entirely to activities of the enemy; the list is swollen because of disability from improper rest, feed and care, which in active service are the rule rather than the exception. A comparatively new, and so far unsolved menace,

[1]Twenty-one motor vehicle manufacturers are now producing six-wheeled, four-wheel-drive trucks. Fifty-three models, in capacity from three to twelve tons, are on the market. At least two truck makers are turning out six-wheelers driving on all six wheels; an experimental eight-wheel-drive model has been built and tested. Several concerns make six-wheel units for installation on the more popular four-wheel types. The four-wheel-drive models have a wide use as tractors, hauling a train of trailers over the highways and other roads that heretofor have not been considered possible for trucks.

is gas. A horse can not put on his own gas mask—granting that it will be effective protection. Once he has it on he is not very useful until it is removed. He will not work well, or hard, in a gas mask; he would much rather fight the mask than get into the collar. We had just begun to learn how to use gas at the close of the last war. What can we expect in the next one?

It has not been determined that draft of all division artillery is one of those functions that can be performed in a satisfactory manner only by teams. "No shibboleth is so sacrosanct that it may not be investigated"; and this must be settled by trying out, from time to time, every reasonable expedient in mechanical draft that is presented.

The trend is certainly in that direction so far as the principal foreign armies are concerned. This trend becomes more and more pronounced with the ever increasing demand of all arms for more speed and greater mobility. Until more conclusive results can be produced with trucks as prime movers for division weapons, we should be content to utilize truck-drawn types in other spheres, at the same time establishing a proving ground for testing their more universal application. This is best indicated by a recent statement of the Chief of Field Artillery to the effect that developments in cross-country trucks "will probably result in the consolidation of the two types, tractor-drawn and portée, of the light artillery of the G. H. Q. Reserve."

That is exactly the theme of this story—to present the practical details of such a consolidation. In addition it is held that it should be possible to move division artillery on the roads as fast as the division infantry can travel over similar routes, and that the present guns will be the weapons to be moved at these new rates of speed, whether they are used as division or reserve artillery.

What should such organizations have in the way of vehicles, men and equipment?

The governing principle of adhering strictly to articles of standard commercial type should be applied as far as possible. This will immediately eliminate such items as caissons, instrument carts, battery and store wagons, reel-carts and rolling kitchens.

BATTERY HEADQUARTERS AND DETAIL

FORD SEDAN

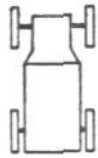
Chauffeur
Detail
Serg't. B.C.

Chief of
Orderly 1st

- *1-Aiming Circle*
- *1-Map Table; built in the Car*

CROSS COUNTRY CAR

Chauffeur
S.C.-1



S.C.-2 R.O.

- *1-Telephone*
- *2-Breast Reels*
- *1-Plane Table and Equipment*

STATION WAGON

Chauffeur
L. G.-2 Sig.
S.B.Opr.

Sig.Corp-1
Serg't. T.-1

- *2-Telephones*
- *2-Breast Reels*
- *1-Switchboard*

STATION WAGON

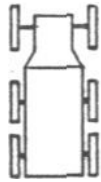
Chauffeur
1. Corp.
T.-4

L.G.-1 T-3
Sig.Corp.-2

- *2-Telephones*
- *2-Breast Reels*
- *1-B. C. Telescope*
- *1-Range Finder*
- *2-Reels;mounted on the Car*

FORD TRUCK

Chauffeur
Orderly
L.G.-4



T.-5
L.G.-3

- *2-Telephones*
- *2-Breast Reels*
- *1-Switchboard*
- *1-Plane Table and Equipment.*
- *1-Hand - drawn Reel*
- *2-Reels;mounted on the Car*
- *Spare Signal and C.P. Equipment.*

A second requisite is to restrict the number of vehicle types to be included in a single organization. The ideal is to have one type only.

The next most desirable thing, if more than one type must be adopted, would be to select the types with a view to interchangeability of parts and principal assemblies. This is usually practicable only when the transportation requirements of the unit can be met with vehicles of similar kind and capacity. It would apply, for example, to combat, ammunition and supply trains. Motorized batteries place such a multiplicity of functions on their transportation that it has not yet been possible to meet them all with a single type of vehicle.

Vehicles are needed in a motorized battery for the following purposes:

1. Draft.
2. Cargo Transport.
3. Personal Transport:
    a. As individuals,
    b. In groups.
4. Wire laying.

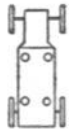
The motor vehicles adopted for these purposes should be capable of performing their duties cross-country as well as on good roads. Until a vehicle is produced commercially with all-purpose possibilities, motorized batteries will be forced to include vehicles of several types and capacities in order to be mobile in all departments. In selecting these, the highest operating and maintenance efficiency will result from vehicles that are standard, and are produced in quantity. Vehicles in this category will be backed up by well developed service and replacement systems; they will be continually improved by private enterprise, and they will be more or less familiar to men enlisted or inducted into the service.

It is possible and preferable to provide one type of vehicle for strictly personal transport. This is indicated in Figure on page 232 for the personnel of battery headquarters and detail, where a Ford chassis with three body types is specified.

Instruments can best be transported in vehicles carrying the instrument operators. An instrument cart is a cumbersome,

FIRING BATTERY

CROSS COUNTRY CAR



Chauffeur
Executive
Inst. Opr
T-2

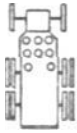
1-Aiming Circle
1-Telephone
1-Breast Reel

FIRST SECTION

5-TON TRUCK TRACTOR GUN ON TRAILER

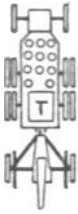
Ammunition Sergt
Chief of Section
Gunner Chauffeur
Tractor Driver 6-Cannoneers 80-Rds. of Ammunition

AMMUNITION SECTION
TWO 5-TON TRUCKS

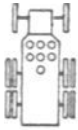


Am. Corp. Chauffeur
6-Am. Handlers 300-Rds of Am.

SECOND SECTION

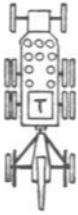


Chief of Section
Gunner Chauffeur
Recorder Tractor Driver 6-Cannoneers 80-Rds. of Ammunition



Chauffeur 6-Am. Handlers 300-Rds. of Am.

THIRD SECTION



Chief of Section
Gunner Chauffeur
Tractor Driver 6-Cannoneers 80-Rds. of Ammunition

AMMUNITION WITH THE BATTERY

80-Rds per Gun Sec - 320	
In Am. Sec	*600*
Total	*920*

FOURTH SECTION

Chief of Section
Gunner Chauffeur
Tractor Driver 6-Cannoneers 80-Rds. of Ammunition

NOTE:—

Trucks and Personnel of the Ammunition Section are a part of the Battalion Combat Train-attached to a Battery operating alone.

Combat Train need not be active in Organizations at Peace Strength.

heavy piece of special equipment, entirely out of place in a motorized battery. When it is used all hands must assemble at the cart to draw tools before they can go to work. If the cart is lost or wrecked—another case of too many eggs in one basket. The work of the detail is largely decentralized; the men should have their instruments handy.

The reel-cart is also consigned to limbo, and dependence placed on breast reels, hand reels or spools mounted on the cars, and the infantry type hand-drawn reel. As outlined here there will be approximately two and one-half miles of wire with the detail. As many spare reels and spools as space permits may be carried in the cargo trucks of the maintenance section. Experience has shown that the reel-cart, when drawn by either a team or a tractor, can seldom venture beyond the gun positions. Hand lines to and from the guns were the rule in the last war, the battery reel-cart finding its chief utility in carrying wire, or picking it up when time permitted, rather than laying it.

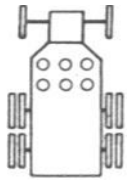
No special provision is made for exclusive individual transport. Most of the work of the detail, except that performed by the line guards, is done by groups. A line guard does most of his work on foot; vehicles have been provided for a logical grouping of the other members. The battery agents with the battalion headquarters and the regimental service battery are expected to obtain transportation from those units. The First Sergeant in the B.C.'s sedan, or a scout corporal in the R.O.'s cross-country car, whichever is most available at the moment, may go back to bring up the battery. Likewise other individuals may be sent off in cars on special missions.

The firing battery, consisting chiefly of four gun sections as outlined before, is shown on page 234. The 5-ton trucks, loaded to capacity, would register 10 tons gross. This would probably be too much for the improvised bridges encountered by division artillery. When a truck is developed having the tactical mobility of a tractor, then a tractor need not be carried on a truck and about 5 tons gross load can be considered. When a battery is equipped as shown here, and although the trucks are six-wheelers with crawler attachments, as they may well be, it is doubtful that they could operate with their towed loads over all types

MAINTENANCE SECTION

5-TON TRUCK

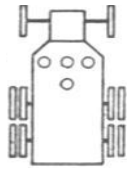
Chauffeur



Supply Sgt.
Chief Mech. — ***General Supplies.***
Mech.-3.
Barber. — ***Baggage.***
Orderly

5-TON TRUCK

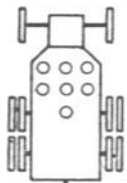
Chauffeur



Motor Corp. — ***Gasolene.***
Gas Defense Corp. — ***Oil.***
Mech.-2 — ***Motor Parts.***

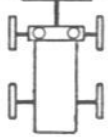
5-TON TRUCK

Chauffeur



Mess Sgt. — ***Rations.***
3-Cooks — ***Gasolene Range.***
2-K.P.'s — ***Field Range.***

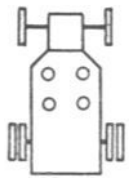
WATER TRAILER



2-K.P.'s

REPAIR TRUCK

Mech.-1.



Motor Officer — ***Tools and Equipment.***
Motor Sgt. — ***Minor Assemblies.***
Mech.-4. — ***Extra Gasolene and Oil.***

of terrain at the front. But the tractors hauling the single axle gun load can go almost anywhere. A few boxes of ammunition placed on the tractors and trailers can be relied on to keep the guns busy until a resupply is brought up by the tractors and a train of trailers.

The two trucks comprising the fifth section are, of course, duplicates of those pulling the guns. They belong organically to the battalion combat train, which attaches them to a battery acting alone. In organizations of this type the combat trains and the ammunition trains need not be active when the units are at peace strength.

Page 236 shows the maintenance section to be composed of the same types of vehicles as the balance of the battery. The personnel and cargo to be transported by each truck is indicated. Only a vastly improved type of rolling kitchen would be of any use to an organization of this kind. When traveling at 3 miles per hour the present models are a source of grief; if put over the roads at ten times that rate—only the birds would be fed. Commercial gasoline burning stoves and ranges designed for camp and marine use are available; they can be obtained with capacity equal to the needs of the battery. Why not slip one of these into a truck for heating water, to make "slum" and coffee on the march, then set up a field range at halts?

A water cart can be used to advantage by our battery. Many satisfactory commercial types are on the market. They should be mounted on pneumatic, or cushion tires, interchangeable with those on the light cars. Incidently, it might be mentioned that the gun-trailer tires are interchangeable with those on the trucks.

The repair truck might either be a light type similar to the other light cars and trucks in the detail, or a heavy type like the gun section trucks. The former will have some advantages in passing up and down the column, and in other off-the-road travel. The latter will have the ability to tow crippled vehicles, can carry a greater load, and is a potential spare for the guns. Actual experience with both will be necessary in order to iron out this, and probably many other details.

A table of organization (page 238) for the battery indicates

that 4 officers and 94 men are needed to operate the battery. The table includes a few rather radical departures; most of these being in the composition of the detail and maintenance section. Everyone seems to be taking a hand in messing up these elements right now, so we may as well be up-to-date. One generic fault with the battery detail, as specified for motorized

1	2	3	4				5	6	7
			Firing Battery						Remarks
		Battery Headquarters and Detail	First Section	Second Section	Third Section	Fourth Section	Maintenance Section	Total Batery	
1	Captain	1						1	
2	First Lieutenant		1				a	1	(a) Motor Officer
3	Second Lieutenants	1					1	2	
	Total Commissioned	2						4	
4	First Sergeant	1						1	
5	Staff Sergeants							3	
	Chief of Detail	(1)							(b) Assistant
	Ammunition		(1)b						Executive
	Motor						(1)		
6	Sergeants							7	
	Signal	(1)							
	Supply						(1)		
	Mess						(1)		
	Chief of Section		(1)	(1)	(1)	(1)			
7	Corporals							13	
	Agent						(1)c		(c) Transported by
	Gas Defense						(1)		Battalion Hqrs.
	Gunner		(1)	(1)	(1)	(1)			
	Instrument	(1)							
	Motor						(1)		
	Scout	(2)							
	Signal	(2)							
	Recorder		(1)						
8	Privates and Pvts. 1c							70	
	Agent						(1)d		(d) Transported by
	Barber						(1)		Regtl., Ser. Bty.
	Cannoneers		(6)	(6)	(6)	(6)			
	Chauffeurs	(4)	(1)						
	Drivers, truck	(1)	(1)	(1)	(1)	(1)	(3)		
	Drivers, tractor		(1)	(1)	(1)	(1)			
	Cooks						(3)		
	Instrument Operator		(1)						
	K.P.'s						(4)		
	Line Guards	(4)							
	Mechanic, gun						(1)		
	Mechanics, motor						(4)		
	Orderlies	(2)	(1)				(1)		
	Switchboard Operator	(1)							
	Telephone Operators	(4)	(1)						
	Total enlisted	(24)	(16)	(10)	(10)	(10)	(24)	94	

FIGURE 1. FIRST MODEL BUILT BY WICHITA MOTOR COMPANY
FIGURE 2. SAME SHOWING METHOD OF MOUNTING GUN ON TRAILER
FIGURE 3. FINAL MODEL. TRAILER IN POSITION TO RECEIVE GUN

units, is that it has been modeled too closely on the plan for horse-drawn units. There was no other experience upon which to draw; we knew pretty well the needs in men and equipment for horse-drawn batteries, and at least had to try out the same thing with the motors. Consequently a half-dozen individual mounts, the abominable motorcycles, were included, largely because the men so mounted rode individual mounts in horse-drawn batteries. Subsequent experience indicates that no individual requires exclusive personal transportation. Also, that the light cars can adequately serve the needs of several different people after the preliminary work of selecting a position has been accomplished.

Three Staff Sergeants have been included, each being the second-in-command of a principal sub-division of the battery. The First Sergeant remains as the principal administrative assistant. A chief of detail, replacing the instrument sergeant; the ammunition sergeant, as principal assistant to the executive at the gun position; and the motor sergeant, being next in command of the maintenance section. These men should be well trained, ready to assume command in case the officer is absent or if he becomes a casualty. There is nothing new in principle about this; every commander designates acting sub-commanders pending replacement. Here the succession is automatic and will be no surprise to anyone, which insures that each department will carry on until the Battery Commander can arrange for replacements.

A few other hobbies have been hard ridden in some respects, viz.:

The battery clerk now practically belongs to regimental headquarters; he has been replaced by a Recorder Corporal with obvious duties.

The Guidon, as such, is not included.

Four motor mechanics are needed to keep eighteen motor vehicles in good day-to-day condition in the field.

A gas defense corporal is designated. Some non-commissioned officer will be given the job in active service. Why not pick him out and train him ahead of time? A similar plan might be followed with regard to the defense against aircraft,

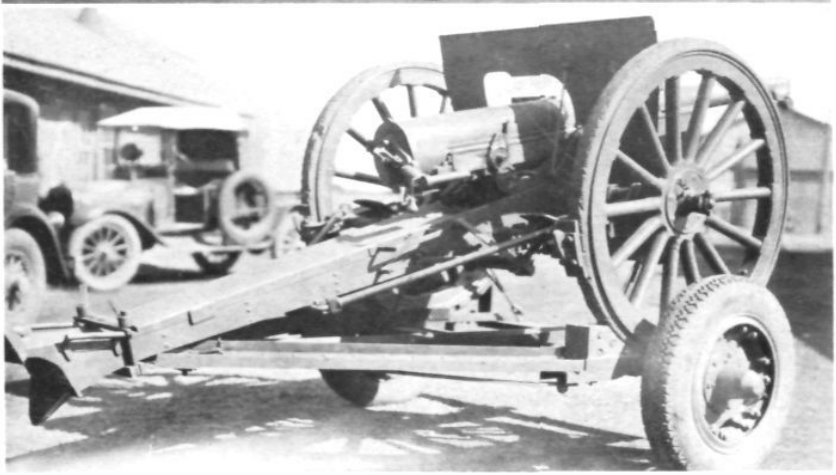


FIGURE 4. MOUNTING GUN ON TRAILER. AVERAGE TIME: 2½ MINUTES
FIGURE 5. LOADED TRAILER BEING TOWED
FIGURE 6. GUN SECTION FULL SPEED AHEAD. (SEE FIG. 7)

were it not for the fact that a better scheme seems to be for a sector defense under battalion control.

The Motor Corporal, in direct charge of the procurement and issue of gasoline, oil and motor parts will be a useful, busy lad. This grade also provides a natural, intermediate step-up from mechanic to motor sergeant. At present motor sergeants are made either from line sergeants who seldom have mechanical experience, or from mechanics who have not had command experience.

Orderlies and K.P.'s are so listed. We must have them—we always get them. Any officer worth his pay is entitled to a "batman", who more often than not doubles as a runner, chauffeur, or cannoneer. Only in the miltary service do we find an attempt to run a kitchen on the plan of changing the help each day. Comparable civilian agencies, such as logging camps, highway crews, roundups, surveying outfits, all depend upon people engaged for the specific purpose of helping the cook. Is it possible that they generally run more successful messes at least partially for that reason?

But all this is somewhat beside the point. It is applicable only in that we are building a new type of organization which may logically require some departure from time honored practices in the use of both men and materiel. The Navy found that out in no uncertain manner, during its transition from sail to steam, and the Army can well study a page or two of the Navy's book.

Doubtless new weapons, either the T-2 or T-3 or something designed for high road speeds on their own wheels, among other essential improvements, will be the future light field gun of the Army. Meanwhile the Field Artillery should not lie passive, waiting for new guns to be designed and built that will enable it to play its proper part in modern warfare. We should not only insist that new weapons be provided as rapidly as current models become obsolescent, but our most certain salvation rests on being a step in advance with our plans for utilizing current models, in meeting new demands for mobility and fire power, as fast as these become crystalized.

FIGURE 7. A TRUCK DRAWN SECTION

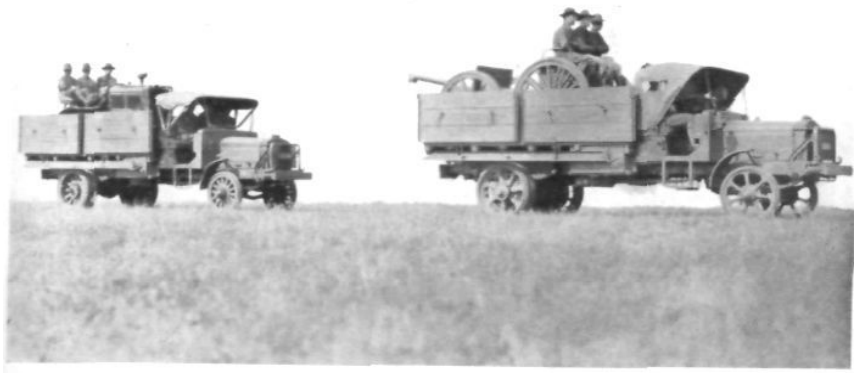


FIGURE 8. THE USUAL PORTEE SECTION

General W. D. Connor, Commandant of the War College, has expressed it as follows:

"It will be found that two kinds of movement must be considered. First, what might be called strategical movements, where long distances are covered in a short time. Second, tactical movements, or movements of troops and fighting machines when they have come in contact with the enemy. It is not impossible that a vehicle will be found that will answer both strategical and tactical purposes. If a single vehicle can be found that will fulfill both purposes, and in other respects be a practical vehicle, so much the better. But if no vehicle having these combined characteristics can be found, then it will be necessary to have some kind of carrier, in order to transport to the point of contact, the combat element which has tactical movement only."

The attempt has been made herein, to present a workable plan for remaining abreast of the times with our present armament, during the critical transition period through which artillery materiel and organization are now passing. The trucks, cars, and tractors specified may be purchased in quantity at a moment's notice, or immediately commandeered off the highways in an extreme situation. Given a set of plans, dozens of motor vehicle plants and factories of similiar nature could begin to turn out the trailers in a few days. It is estimated that by the time existing and reserve artillery units are recruited to strength and equipped, their guns, trailers, and other vehicles would be ready to move them. All this at less cost than for any other type of artillery now in existence.

Lastly, when organized and equipped in accordance with the plan proposed here, the units would enter the field endowed with the ability to move, both strategically and tactically, in accordance with new demands for mobility. Also, all elements of the batteries could move at the same rate. There would be no need for dividing into three columns on a road march, as now required, because of inherent differences in speed between radically different vehicle types incorporated within the same organization.

FLYING BATTERIES

By 1ST. LIEUT. LOUIS B. ELY. 2ND, F.A.

BATTERY B, SECOND FIELD ARTILLERY (75MM. HOW.) IN POSITION AT LA VENTA RANCH, REPUBLIC OF PANAMA, AFTER FLYING THERE

CARRYING Field Artillery in airplanes has been made practicable by the development of the new pack howitzer. This was demonstrated on March 20, 1931, by Battery B, Second Field Artillery, Captain Henry E. Tisdale commanding, and planes from the Sixth Composite Group. Air Corps, Lieutenant Colonel James A. Mars commanding. The battery took off from France Field. Canal Zone, at 8:00 A. M. and landed at La Venta Ranch, Republic of Panama, at 8:55. It went into position and fired a salvo of banks at 9:12. Distance traveled: 76 miles.

The idea of such movement came as a result of discussion of a proposed march across the Isthmus by Battery B. This had taken Battery A thirteen days in 1923. I had proposed cutting this to eight days by careful reconnaissance of the route, assisted by maps not heretofore available.

"A week or two weeks to get here," mused the battery commander. (We were on manoeuvres near Chorrera). "Even with the railroad out, there must be some quicker way. Why couldn't we do it by air?" And the thing was started. Captain

ABOVE: 75MM. HOWITZER BEING LIFTED INTO KEYSTONE BOMBER
LOWER LEFT: FORD MONOPLANE ABOUT TO TAKE ON A PACK HOWITZER
LOWER RIGHT: THE NEW PACK HOWITZER PACKED FOR FLYING

Tisdale asked Major Wogan, who was enthusiastic. Major Wogan found the Division Commander, General Roberts, also enthusiastic. By the time the matter came before the Department Commander, Colonel Mars had agreed to its practicability.

As the Battery was to go to La Venta in a few weeks for test firing of experimental shell and fuses and for Knox Trophy firing, it was decided that that would be a good time for the test.

Two days ahead of time we took the howitzers to France Field. Arriving at the hangar of the Twenty-fifth Bombing Squadron, we found the big ships had been pulled out and were waiting for the experiment. We met Captain James A. Healy, commanding the squadron, and a large group of interested Air Corps officers.

"We've carried most everything else—we can certainly carry your guns and be glad to," was the consensus of their remarks.

The pieces were put in draft position, as being the most compact and logical way to load them. One was rolled under the bomb bay of a Keystone. It was hoisted slowly up, axle and wheels released. Two bomb hoists had to be used, to keep the howitzer centered. As there were but three hoists, two bombers stood idle. Into one of these, through a hole in the rear of the board floor of the bomb bay, Air Corps men placed another howitzer, part by part. As they lay, they were difficult to lash, and our recoil mechanism was in danger. Taking the parts out again, Sergeant Matlock, with his First Section, put it back in—airmen looked worried about damage to the plane by cannoneers. The parts were handed up in proper order—front trail, cradle, and so on to rear trail, and assembled in draft position on the floor, a compact mass. Wheels and axle were handed in and lashed. The piece was then unloaded and loaded against time. Eight minutes and ten minutes respectively. The solution had been found. The time was later cut to six minutes for each process. This was faster than using bomb hoists.

The weight put a strain on the flooring. The line chief, Mr. Sgt. Tate, built a special flooring he called a gun rack, for each

of three of our sections. They are now a part of our flying equipment.

The Ford, built for distributed weight of passengers, was then equipped with cross-boards bolted to the floor. Howitzer parts were now distributed over these boards in accordance with the desires of the airmen, and bolted to the boards by steel straps. This work was also done by France Field men.

It was settled that a pilot, mechanic, and three artillerymen could ride in each bomber. The chief of section, gunner, and one cannoneer thus went with each piece. The giant, graceful Ford, we found, had less lifting capacity, and could take only the chief of section in addition to its howitzer and crew.

Ten more cannoneers were then shown where they were to ride in the Sikorsky amphibians. Total, twenty men. Had we had one more Sikorsky we would have been pretty well fixed. Major Wogan and the Captain were to ride in the Sikorskys, and I was to go ahead as reconnaissance officer in the O-2 plane.

The ships were to return and make a second trip. They would bring Lieutenant Follansbee, six detail men, some Headquarters Battery men, the Knox Trophy Board, the Camp Surgeon, Captain L. H. Ginn, and a few more cannoneers. I wanted these latter because we were going to fire for the Knox Trophy. Only the detail men were a necessary part of the flying detachment. The rolls of the officers and men were also assigned to this second trip. This trip brought almost the equivalent of another battery.

The remaining lieutenant, Hutchison, was to proceed by rail, with a few men, to Corozal, get the 400 rounds of *T*-4 shell, and proceed by light truck to La Venta.

The assumed tactical situation was as follows:

Simultaneously with the declaration of war a Black fleet of fast cruisers, transports, and carriers reached the coast of Panama near Aguadulce, this in the night of March 19-20. At dawn a bombing attack on the Canal was defeated by our air forces and their bombing forces seriously injured. Thereupon the raiding fleet landed its land forces which moved rapidly on the Canal. The Thirty-Third Infantry, moving by truck, met its

advanced elements near Rio Hato. It mission was to delay the enemy. We then assumed that at 6:00 A. M. March 20th, the Commanding Officer, 1st Battalion, 2nd Field Artillery received the following order:

"The General directs that you arrange with the Commanding Officer, France Field, to move one battery to the vicinity of Rio Hato by plane immediately."

At 6:15 at Gatun the Battalion Commander instructed the Battery Commander of Battery B to leave his animals and ten men at Gatun, to take the flying detachment by truck to France Field immediately and to have the remainder of the battery entrain (constructively) on the siding at 7:00 A. M. Upon arrival at France Field, he would be furnished three Keystone bombers, a Ford transport, and two Sikorsky and one O-2 observation planes. In these he would enplane, proceed to the vicinity of Rio Hato, and take up a position in support of the Thirty-third Infantry.

The flying detachment for the air equipment available, consists of battery commander, executive, reconnaissance officer, four chiefs of section, four gunners, twelve cannoneers, six detail men, the four howitzers with their accessories, a little wire, and instruments.

At 6:30 A. M. on March 20 the detachment was entrucked in two Class B trucks; three howitzers and nine men in one truck; the remaining personnel in the other. The battery arrived at France Field at 7:15. I had preceded the battery in a car, and was just leaving in the O-2, as reconnaissance officer. The previously arranged schedule called for loading to commence at 7:45. The signal to enplane was given at 7:47. The Fourth Section was loaded into the Ford in five minutes. The bomber sections loaded in six, seven and eight minutes respectively. Parachutes were put on, sections reported, and the battery commander reported his battery ready. The planes left their parked positions, one by one, taking off between 8:00 and 8:03 A. M.

So far it had been nothing but hard work for the cannoneers. Now they looked down on the surroundings in which they had lived for many months. They saw Colon, Gatun, Randolph,

the Lake, and the ocean all at one time. There was the tortuous road over which they had led their mules so often. In ten minutes they were over their own corrals and barracks. In ten minutes they had covered the route which usually took them two and a half hours of hard marching. "This beats leading a mule", they said. Out over the lake, dotted with islands and projecting tree trunks, they recalled the words of the parachute instructor: "And if you don't jump out of the sling before you hit the water, the chute will cover you and you'll drown."

"If I ever get the chute open I'll be lucky," was the answering thought.

Over the jungle. Here, ten minutes of flight was a full day's march. Across the mountains they saw the Pacific. They flew southward over the mountains and turned south-west. Chorrera and the open flat country on the left. Chorrera had seemed like the end of the world to these cannoneers some few short weeks before. Up the National Highway.

"Our ten minutes here", said the Captain, "is an hour for ordinary portée, half an hour for the material in light trucks."

Over the pass at Campana, they continued on down the coast, until they saw the O-2, whose pilot signalled them landing signals.

When I had reached Rio Hato, I had pictured as best I might the tactical situation, selected as best I might a battery position area, and got Lieutenant Biggs, the pilot, to pick out a landing field near it, on La Venta Ranch. I was landed, found an imaginary Infantry colonel, picked a battery position, and an O.P. Actually, instead of the Infantry colonel, I found Mr. Kierulf, the very cordial owner of the ranch, Colonel Honeycutt, G-3 of the Department, and various cameramen. They watched the eastern sky for the approach of the battery. At 8:35 they saw the ships to the north-east. At 8:50 the planes were over us.

The Ford landed first. I poked my head in the door and asked the pilot to taxi toward the battery position. The bombers followed the Ford, all coming much closer to the position than I had thought possible. Cannoneers came piling out, surface

boards beneath the bomb bays were removed, and, piece after piece, our howitzers came out of the bellies of the big ships. I helped the lone chief of the Fourth Section unload. The Sikorskys landed with more cannoneers. I went to the battery position. The Fourth Section was ready to fire at 9:05.

The other pieces, drawn by two men each, and followed by the remaining cannoneers with sights and all accessories, came down the line of planes at a run to their positions. The Captain shouted direct fire commands, and the first salvo went at 9:12. Had not the Ford (at my request) been landed first some few minutes would have been saved. The Air Corps mechanic had assisted the chief of section to unbolt his howitzer parts.

The planes took off for France Field and brought over the remaining personnel and baggage. The show was over. Although the same planes took us back after we had completed our five days of firing, there wasn't quite the same kick in it.

We had a new type of mobility for the battery. Our "rate of march" was eighty miles per hour. The obstacles it can pass include mountains, lakes, jungles and enemy front lines.

But why rave about the obvious advantages. Soberly, the disadvantages: lack of cannoneers, of ammunition, of ground transportation, of air fields, and of course, of air transportation.

With proper ammunition the lack of cannoneers is not serious. Fewer cannoneers are needed with the latest shell and fuse—the T-4 and the T-1, E-1 respectively, by two per section. The new howitzer can be manhandled by less than half the cannoneers required for its present equivalents or inferiors (such as the French 75mm. gun). The wire carried can be sufficient to tie into a battalion net of the reenforced artillery, the battery officers will have to set up their own instruments, and makeshifts must be made until the remainder of the battery can join. The battery overhead can be dispensed with until brought up—the three officers and twenty enlisted men can be fed a few meals by the reenforced organizations.

The lack of ammunition is more serious, similar to the lack with portée and pack. If there are ammunition reserves near the point of the battle line we are sent to, we use it, as portée

does. Otherwise, the ammunition must be sent by truck. If the ammunition is no closer to the position than the battery itself, perhaps not much is gained. But if there is only *some* there, the rest can overtake the battery later by truck. Either of these shortages can be solved by more planes, of course.

Lack of air fields and ground transportation has many remedies with this light howitzer. From wherever it lands it can be carried by a light truck or towed behind a light passenger car. The regions where there are no practicable landing fields, natural or artificial, and no cars or trucks of any kind obtainable, are in the minority among our probable future theaters of operation. And, even in such regions, experiments will likely prove that the guns and crews can be dropped by parachute, and that the men can pull these guns for very considerable distances. We expect to make the two latter experiments in the near future.

The air transport must come primarily from the transport planes assigned the Army in time of war; secondarily, it will come from the bombers. Had our problem actually involved war, transport planes of the Pan-American Airways could have been used. One trip could have taken six more men and some ammunition—the second, some 550 rounds more of ammunition. The availabilty of planes probably was less than it will be in most theaters in time of war. It is less than will be the case here in the very near future, for more and bigger planes are soon to be assigned to France Field. And when planes are assigned to carry troops, they can hardly carry anything of more value in the ground battle than these powerful, flexible, accurate, highly mobile, inconspicuous, rapid firing howitzers.

"The battery will follow at four miles per hour," was yesterday. The battery can now follow at eighty miles per hour.

FIELD ARTILLERY WITH THE MECHANIZED FORCE

By CAPTAIN ARTHUR WILSON, F.A.

WITH the arrival on February 28 of the Signal platoon of the Headquarters Company, which was trained and equipped at the Signal Corps School, Fort Monmouth, N. J., the organization of the Mechanized Force was completed except for the Quartermaster Motor Repair Unit, which will be sent in July from Camp Holabird, Md. All other units of the Force have been at Fort Eustis, Va., since last November.

The Field Artillery is represented in the Force by Battery A of the Sixth from Fort Hoyle, Md., consisting of five officers and 127 enlisted men, and by two officers on the staff. At the present time* the battery, in common with all other units, is in the midst of an intensive training program which includes not only individual and battery training, gunners' examinations, annual target practice, and other normal battery routine, but also its share of the work entailed in developing the necessary coordination within the Force and its tactical missions. The weekly tactical exercises take it over most of the Virginia Peninsula, a single problem extending as far as 75 miles for the entire Force, with reconnaissance vehicles and armored cars covering well over 200 miles a day.

While the Mechanized Force is a new organization, it is by no means comprised of new units, as nearly all of the components have been motorized for months or years; and practically all of the officers have had extended motorized experience. It has therefore been possible to launch immediately into a program of training to develop its tactical role through extended maneuvers which would not have been possible had the Force been newly recruited and its personnel untrained.

MECHANIZATION AND MOTORIZATION

In the paragraph above we have referred to both *mechanized* and *motorized* units; and before we go further into the internal organization and tactical role of the Mechanized Force it will

*Note, March, 1931.

be well to point out that, in order to avoid confusion of thought, the War Department has seen fit to define and differentiate between "Mechanization" and "Motorization."

Mechanization is defined as: "The application of mechanics directly to the combat soldier on the battlefield."

Motorization is defined as: "The substitution of the motor propelled vehicle for animal drawn in the supply echelons of all branches of the Army, and in providing increased strategical mobility for units of all types through the carrying of men, animals, and equipment in motor vehicles over roads."

Mechanization is not, as is sometimes thought, the substitution of tanks, armored cars, and self propelled mounts for Infantry, Cavalry, and Field Artillery; but is rather the establishing of a mechanical footing and power for units instead of muscle power as a means of moving and fighting. When applied to armies it includes other things than motive power—it applies to arms. When a fighting unit is mechanized that unit depends upon mechanically propelled vehicles, as the tank and the armored car, which in themselves are weapons as well as carrying vehicles; and also upon weapons that are hauled or carried, as machine guns and portée or self-propelled Field Artillery. Heretofore, we have had in our Army motorized units, as those in the Field Artillery. We have also had armored units, as the tanks and armored cars. Now we have combined them all and we have a mechanized unit—a Force that has mechanical vehicles and mechanical weapons. Its capacity for moving and fighting is expressed in terms of machines.

When a unit is merely carried or hauled from one place to another by its motor and mechanical transport for the sake of rapidity of movement and the saving of men and animals from hardship and fatigue, and then goes into action in the same manner as if its transport was horse drawn, the unit is motorized. There is a great deal of difference between the two terms and it is well to understand the distinction between them.

The Field Artillery pioneered in motorization in our Army when the Ninth Field Artillery was organized in Hawaii in 1916 and became the first motorized regiment in any army in

the world. Immediately after the war Major General Snow, then Chief of Field Artillery, prescribed a thorough course in internal combustion engines and in motor transportation as a part of the course taken by all officers at the Field Artillery School. The motor course was started at Fort Sill with the class of 1919-1920. This was followed by the establishing of regimental motor schools in all motorized regiments and of the 11th F. A. Brigade School in Hawaii, through which many officers have passed.

The Army enters the mechanized era with a considerable number of its personnel already experienced in motorization. This varies in the several arms according to the degree of importance that has been placed on motorization and the length of time the subject has been taught in their service schools. In this day of motor transportation in civil life it is easier to recruit men who have had experience with motors than it is to get men who have driven horses, so the problem of drivers is not a difficult one. In passing, it might be mentioned that the Air Corps is completely mechanized, for there a man fights from a mechanical vehicle with mechanical weapons.

While the United States Army has led in motorization we have not led in mechanization in spite of the fact that we are the greatest machinery country in the world. To date the British army has gone further into mechanization than any other, although France, Italy, Poland, Russia and Germany are all committed to some degree of mechanization.

"A new element foreseen as a development in the armies of the future is the Mechanized Force," wrote General Summerall in his final report to the Secretary of War; and as one of his last official acts as Chief of Staff, he ordered the organization of such a force. It is to take advantage of the acknowledged leadership of the United States among the nations of the world in the automotive industry, to exploit to the fullest extent possible the mechanical and scientific fields of the nation in the interests of National Defense, and to reflect in the organization of the Army the mechanical age in which we live that the Mechanized Force is constituted. It is not only a self sustaining organization designed

to fulfill a particular and necessary role in the organization of the Army, but constitutes a field laboratory to develop the tactics for such a force and to test mechanical vehicles and weapons suitable to its use.

ROLE OF THE MECHANIZED FORCE

The conception of a mechanized force in this country is one in which the modern fast tank, because of its speed, armament, motoring radius, and mechanical dependability, becomes the principal weapon, all other units being auxiliaries to it in order to furnish something that the tank lacks, to augment its fire power, to increase its fighting strength and to provide the necessary information, command, supply, and maintenance services. Through such a force it is hoped to regain the mobility on the battlefield which has been largely lost because of the inability of unprotected troops to advance in the face of automatic weapons without heavy losses.

The primary mission of the Force, as laid down by the War Department, is, "To provide higher commanders with a powerful weapon of tactical and strategic opportunity, where the mission indicates the desirability of employing a force whose characteristics are high tactical and strategic mobility, hard hitting power, high mobile defensive power, limited holding power, and one which is capable of sustained independent action. * * * Its ability to crush its way forward over highly organized ground in the face of stabilized resistence is secondary."

Strategic mobility includes, among other things, the ability to cover long distances on roads; therefore the present vehicles of the Force that are not built for high road speed, as the tanks and artillery, are transported on carriers when on the road. Tactical mobility is the ability to maintain the power of maneuver in battle and on ground leading up to the battlefield; the Force therefore has vehicles using caterpillar tracks and light cars capable of cross-country movement. To get strategic mobility, all caterpillar vehicles are carried when on the road and are detrucked when tactical mobility becomes necessary. As organized, the Force has a sustained road speed of at least twenty miles

per hour, and a maneuvering speed surpassing any combat force known today. It can cover one hundred miles easily in a day and be prepared for combat when it arrives at its destination.

The Force is mainly offensive. Over favorable terrain it can be used as a spearhead in an important attack; can seize and temporarily hold distant key positions; can be used in attacks involving turning and wide eveloping movements; as a counterattack and pursuit unit; as advance or flank guard of large motorized units and as a rear guard using tanks to break up pursuing forces; in the break-through and exploitation; to defend a shore line; to cover concentrations; for distant strategical reconnaissance and as a powerful general reserve. Its principal value lies in its mobility; its success depends upon speed, surprise and hitting power. Hitting power is built on speed, armor, automatic weapons and Field Artillery.

To carry out the mission and tactical role laid down by the War Department, the Force is equipped with means for administration, command, maintenance and supply, ground reconnaissance, and for defense against air attack; and it is provided with an attack unit, a holding unit and supporting units. It consists of a Force Headquarters and ten organizations: Headquarters Company, Armored Car Troop, Anti-aircraft Detachment, Tank Company, Machine Gun Company, Chemical Detachment, Field Artillery Battery, Engineer Company, Ordnance Company and Quartermaster Repair Section.

COMPONENTS OF THE MECHANIZED FORCE

Force Headquarters. Because of the tactical role of the Force and the speed with which it will maneuver, it is apparent that a technique of command and a system of communications must be developed that will be different and more advanced than anything that has heretofore been accomplished. There must be evolved the coordination between units, the internal tactics of the Force itself, as well as the tactics of the Force acting as a unit and in cooperation with other organizations. The problems incidental to the maintaining of the Force as a field laboratory for the testing and developing of its equipment will be many. For these reasons the Commanding Officer has been given a

complete staff consisting of Executive Officers, Adjutant, Assistant Adjutant (personnel), Intelligence Officer, Plans and Taining Officer, Supply Officer, Assistant Supply Officer, Liaison Officer and a Commanding Officer of Special Troops. This last named officer is a major and has administrative command of the headquarters company, anti-aircraft detachment, chemical detachment, ordnance company, and quartermaster repair section. He also commands the field trains. The commanding officers of the chemical and signal detachments also act as chemical and signal staff officers.

Headquarters Company. The Headquarters company has an administrative section, supply platoon, and signal platoon.

The administrative platoon consists of one officer and 53 men, drawn from the first four Corps areas; it takes care of the usual overhead of Force headquarters and provides cooks, chauffeurs, etc.

The Supply platoon, from the Quartermaster Intermediate Depot at Camp Holabird, Md., comprises one officer and 20 men and corresponds to the service company in a regiment. Its cargo trucks operate as a field train.

The Signal platoon of one officer and 28 men was specially trained and equipped at Fort Monmouth, N. J., before arrival at Fort Eustis. It is at once apparent that the problem of communication within such a force where the units may be scattered for miles, the transmission of orders within itself and liaison with other units and with the Air Corps, is an important and difficult one. The battle command post must be able to adjust itself to rapidly changing situations. Communication consists of motorcycles and cross-country cars, wire carts, visual and radio. Up to the present time communication in our problems has been by wire and by motorcycle messenger, the use of the former being the exception. With the arrival of the Signal platoon the main reliance will be placed on radio. The battle command post is in a T1E2 tank in which is installed a tank radio set, for communication to the tank units, and a radio telegraph command set with which the Force Commander can communicate with his armored cars, Field Artillery battery, machine guns, and tank company, all of which are equipped with similar sets.

A tank radio set is also provided for each tank platoon, as well as the tank headquarters. The command post is also provided with a Reo speed truck (in which is installed radio and wire switchboard) and with a FWD truck similarly equipped. With the air sets the Force Commander can communicate with the Air Corps, back to his base, and to the Army or Corps to which he may be attached. A wire net is provided which may be laid between the command post and the Field Artillery battery, machine gun company, and to the Force base.

Armored Car Troop. The ground reconnaissance element is provided by the armored car troop of five officers and 54 men from the Second Cavalry Division. (In addition to ground reconnaissance the Force will have available air reconnaissance). With the Armored Car Troop reconnaissance can be pushed on the ground far beyond anything that has ever been gained on horse or by foot. The mission of the armored cars includes distant reconnaissance, counter-reconnaissance, use as a security force to maintain liaison, to provide battle reconnaissance by developing the flanks and determining the enemy's position, to exploit the success of the Force, and to cover rallying and withdrawal.

The troop is organized into a headquarters, consisting of an armored radio car, cross-country car and a solo motorcycle, and four platoons. The first platoon consists of three cars, the second two light cars, the third two medium cars, and the fourth three medium cars. Each platoon also has one solo motorcycle.

The cars are built for rapid movement and, because of the large number of automatic weapons carried and their armor, they have a high degree of fighting power. All light cars are armored with three-sixteenth inch armor with turrets equipped with quarter inch armor; and the medium cars are armored throughout with quarter inch armor. The light cars carry one .30 caliber Browning air-cooled machine gun and a crew of three. The medium cars have a crew of four, and are equipped with one caliber .50 machine gun and two .30 caliber machine guns, all air cooled. Approximately 3,000 rounds of ammunition are carried in each car, and they can run about 200 miles on one filling of gasoline. Each vehicle is also equipped with a Thompson

sub machine gun. The troop has a total of 38 machine guns and carries about 100,000 rounds of ammunition, in addition all individuals are armed with the automatic pistol.

Anti-Aircraft Detachment. To protect its fighting, as well as its vulnerable non-fighting vehicles, an anti-aircraft detachment of one officer and 19 men from the 69th Coast Artillery Corps is provided. It is equipped with one White truck with a dual .50 caliber mount and two FWD trucks carrying single .50 caliber guns and mounts. It is organized to give close, powerful, emergency defense against hostile aircraft.

Tank Company. The tanks are the offensive backbone of the Force, the unit for which all others are auxiliaries. The company of five officers and 88 men is from the First Tank regiment at Fort Meade, Md. It is equipped with 21 tanks, two of which are radio and command tanks, three light tanks Model T1E1 (which is the latest tank developed by the Ordnance Department), six six-ton tanks Model 1917, which have been remodeled and equipped with Franklin motors, and twelve six-ton tanks Model 1917. To get the necessary strategical mobility the tanks are carried on six-wheel trucks developed by the service and built at Camp Holabird, Md.

All tanks are armored with .25-inch to .6-inch armor and carry a crew of two men. The T1E1 tanks carry three .30 caliber Browning machine guns, air cooled, and one 37mm. gun. One of these tanks is equipped with a semi-automatic 37mm. gun, and the other two with the standard weapon. The other tanks carry an armament of either one .30 caliber machine gun or one 37mm. gun.

Machine Gun Company. The tank is a vulnerable target when halted in a zone of hostile fire, and a position once taken cannot be held by tanks alone; and therefore, we have a machine gun company to take over promptly conquered ground, hold it, and to further exploit the success if possible. In an attack the machine gun unit follows to the limit of the tank attack, takes up the best defensive position, temporarily consolidates it, holds, and covers the withdrawal and reassembly of the tanks. The machine gun company does this through the power of its own automatic weapons, the protection of its own riflemen,

and the supporting fire of the chemical detachment and the Field Artillery battery, aided perhaps by the Engineer company, which may be used to construct artificial obstacles.

The company of three officers and 70 men is from the 34th Infantry (the only motorized Infantry regiment) at Fort Eustis. It is organized into three platoons of three guns each, with three more guns in reserve. Each gun has a crew of four men for the machine gun and two riflemen. Each gun is carried on a six-wheel Chevrolet cross-country truck. When detrucked the guns run on rubber tired carriages pulled by hand. With each gun is 10,000 rounds of ammunition, or 120,000 rounds with the company.

Engineer Company. To take care of obstacles, which might seriously delay the Force on the march and across country, a company of Engineers especially trained and skilled in the construction of small bridges and the repair of large ones, and for the inevitable field engineering work that must always go with any organization, is provided. In the defense it can aid the machine gun company by constructing artificial obstacles and barricades, lay wire, put out anti-tank mines etc. In a withdrawal it may use demolitions.

The Engineers are provided by Company C of the 13th Engineers from Fort Humphreys, Va., with a strength of three officers and 90 men.

Chemical Detachment. Smoke is one of the most valuable agents in the assistance of tank attacks and in the screening of enemy anti-tank weapons during the withdrawal of tanks from action. The detachment consists of one officer and 15 men from the Chemical School at Edgewood Arsenal and is equipped with a 4.2 inch rifled chemical mortar, which can fire high explosive shells as well as smoke or chemical shells. The mortar is mounted on a T1E1 cargo chassis and is carried on a tank carrier to give it road mobility consistent with the rest of the Force.

Ordnance Company. It is natural that the maintenance, supply, repair, and salvage of broken down and damaged vehicles in such a Force will be a complicated one involving many technical and mechanical problems; and as the Field Artillery has

learned from sad experience, this problem increases with the age and mileage of the vehicles.

The mobile Ordnance company takes care of all track laying and all Ordnance material. It is equipped with a new mobile machine shop mounted on a five-ton FWD truck, a generator truck and other special tools for the repair and overhaul of vehicles. The personnel of 2 officers and 55 men came from the Aberdeen Proving Ground.

Quartermaster Repair Unit. The Quartermaster mobile repair unit takes care of all wheeled vehicles and all Quartermaster equipment. Like the Ordnance it is furnished with specially trained personnel and special equipment to take care of wrecked and damaged vehicles and to provide for their upkeep and maintenance. The unit comes from the Quartermaster Intermediate Depot at Camp Holabird, Md.

PROBLEMS OF THE FIELD ARTILLERY

The Field Artillery is inculcated with the doctrine that the sole reason for its existence is its ability to assist the other arms upon the field of battle. Its role in a mechanized force, where the principal weapon becomes the fast tank, is the same as if it was supporting an Infantry or a Cavalry division. But because of the speed of attack of a mechanized force, the character of the ground weapons that will be brought to bear against it, the other armored fighting vehicles which it will undoubtedly encounter, and the fact that it will probably have to give closer support than has been the case with other elements in the past, the tactics of the artillery and the proper execution of its role demands the solution of problems involving tactical mobility, speed, close support, communication, liaison, methods of fire, ammunition supply, and organization within the battery, which are not yet generally appreciated in our army. The artillery battery must be very versatile for it is required to have all of the normal attributes of supporting division artillery plus the tactical mobility of accompanying guns. The characteristics of division artillery are tactical mobility and fire power. Strategical mobility is of a low order. The characteristics of portée

artillery are strategical mobility and fire power. Its tactical mobility is of a lower degree. The artillery of a mechanized force must have both strategical and tactical mobility of the highest degree; or at least equal to that of the fast tanks which it is to support. It must adjust itself to support an advance, not of 100 yards in four minutes or a mile in one hour, but to a rate of perhaps ten miles or more in an hour. Such an attack will gain ground so fast that observation of fire from any place except with the guns may be made very difficult if not impossible.

Any successful attack demands fire superiority. To enable tanks to advance in the face of hostile fire the artillery must be capable of reducing pill boxes, machine guns, 37mm. guns and other anti-tank weapons—and do this in time to be of assistance; and it may have to neutralize the enemy light artillery. It must be able to go into position speedily, to concentrate quickly behind sensitive points, to fire rapidly, and to displace forward at a rate comparable with that of the remainder of the attacking force. It has to be prepared to support and to accompany the advance with smoke and shell; in a pursuit, to have the range to reach well out into the enemy zone; and when the Force is holding, to protect with its fire power the machine guns and the reassembly of the tanks. The artillery must be able to train guns quickly and effectively on such fleeting targets as armored cars and fast tanks. The tactics of tanks at close ranges calls for rapid changes in deflection through big angles and the shortest possible elapsed time between rounds. It may not be a problem of hitting one tank but several tanks advancing from many directions and at different angles. Many of these problems envisage direct fire at close ranges in order to cut to a minimum the time between the request for fire and its actual arrival.

Trying to do all of these things with guns that have been designed primarily for entirely different missions makes many problems. How is the Field Artillery best to accomplish its mission? How is the question of close support to be solved? Should the guns be normally with the attacking unit, or at a comparatively greater distance from it? If at a distance how is the artillery to get information that will be complete, instantaneous,

and frequent? Will the best communication be telephone, visual, radio or a combination of them all? To get the required mobility, should the guns be carried or hauled? Tractor drawn, truck drawn, or self propelled? Without armor equivalent to that of the tanks will it be possible to accompany tanks? Is movement within an enemy zone under such conditions within the realm of possibilities? What protection for personnel is desirable and essential? Keeping in mind that the heavier the armor the smaller must be the gun, if the vehicle is to have the same mobility as an unarmored gun, what should be the caliber of an accompanying gun; a 75mm. or a smaller caliber? What new types of accompanying and supporting artillery must we have and of what characteristics?

What is the best method of laying on a rapidly moving target? Should fire be controlled by battery or platoon, or should each gun fire separately? Should the battery or platoon commander handle both range and deflection or should he correct for deflection only and allow the gun commander to correct for range? Or should the gunner correct for deflection and the gun, platoon, or battery commander give ranges only? Should the gunner follow the target and try to anticipate its direction and hold fire until the target passes into the danger area, or should he attempt to fire on it at all times? When using a panoramic sight should the section chief set off the deflection changes leaving the gunner free to do nothing but stay on the target and give the command to fire? Will we have to go into the difficulties of prediction as is now practiced by the Coast Artillery and the Anti-aircraft artillery? Must we evolve rates of changes for deflection and range based on speed of the target? Is a director, or automatic computer, feasible for use? And what should be the method of fire? Should we start with a bracket adjustment immediately and go to continuous fire when a suitable bracket has been obtained, or should it be continuous fire from the start? Should the range finder be used by two men, one keeping on the target and the other continuously reading ranges? How many rounds per minute can be expected? For shooting on rapidly moving targets how do self-propelled guns compare in accuracy and results with guns on carriages and with trails? How is the

battery commander's detail to operate and what type and number of reconnaissance vehicles should it have in order to have the proper mobility and flexibility or the power of subdivision into small units? Should the vehicles be armored? What members of the detail must have independent mobility? How large should the detail be? What fire control equipment, if any? How is ammunition to be carried? What kind of ammunition should be carried and how much? If portée or tractor drawn artillery, what added protection must the carriers or the tractors have?

To get the comparative value of self-propelled and portée artillery for the Mechanized Force, and to test and develop other material suitable for such a force, the battery has been issued a variety of vehicles which gives it more to take care of than any other unit in the Force. In addition to a complete portée battery of French 75mm. guns, caissons, reel and cart, all drawn by Caterpillar "20" tractors and hauled in Standard B trucks, it has two self-propelled American 75mm. guns, Model 1916, mounted on Mark VII chassis, one self-propelled 75mm. pack Howitzer mounted on an Ordnance track development chassis, an experimental motor reel mounted on a T1E1 chassis, one ammunition carrier on a T1E1 chassis, one bogie axle for a 75mm. gun, tank carriers for the self-propelled mounts, one five passenger Ford touring car, three Indian solo motorcycles, a kitchen truck (which consists of a Liberty kitchen modified to burn gasoline, wood, or coal, mounted in a two-ton FWD truck), a 300-gallon water trailer, three two-ton FWD cargo trucks, one G.M.C., and the other normal battery equipment. For close defense of the guns and for protection of the carriers the battery has two .30 caliber Browning machine guns and ten Browning automatic rifles. The present standard B trucks, which have solid tires, will be replaced in May with a modified B truck equipped with Continental motor and pneumatic tires. This will give the battery a higher sustained road speed than it has at present.

So far the portée battery of four French 75mm. guns has been used by the Force commander in the normal role of supporting artillery, but at very close ranges. The three self-propelled

mounts have been used as accompanying guns, one gun accompanying each of the three tank platoons in attack.

Materiel. A word of explanation about some of the materiel may be of interest. The Caterpillar "twenties", of which there are seven, are the regular commercial tractor modified to have radiator guard, Ordnance pintle, front towing bar, and three seats, which have been adopted as standard for our light artillery. It weighs 7,500 pounds, engined with a four-cylinder Holt 25 HP motor. New gears will soon be put in which will give them speeds of about two, six, and nine mph, or nearly double the present speeds.

The self-propelled American 75mm. guns on 2½-ton tractors, equipped with Cadillac motors and Cadillac transmission, are the same ones with slight modifications that have made their appearance from time to time at several artillery posts ever since 1920, when not in the museum at Aberdeen. They have a total mileage of about 10,500 miles to date. The vehicle weighs 10,600 pounds and has a maximum speed of about 10 mph. It carries 18 gallons of gasoline, 8 quarts of oil, and gets about 2 miles to the gallon. As mounted on the carriage it has a range of possible elevations from 0 to 900 mils, which carries it beyond the maximum range of the gun (8,780 yards at an elevation of 766 mils) firing shell with short fuze and a normal charge. The traverse each side of center is 322 mils. The engine and chassis are protected with ¼-inch armor but there is no protection for the crew and no capacity for carrying ammunition.

The 75mm. motor carriage T1 consists of a pack Howitzer mounted on an Ordnance track development chassis. It is engined with a V-8 LaSalle motor of 86 BHP, weight 11,300 pounds complete (the Howitzer weighs 1,298 pounds), has a maximum speed of 21.3 mph, carries 16 rounds of ammunition, 30 gallons of gasoline, 14 quarts of oil, and makes two miles to the gallon. It can carry a driver and a crew of four, but at maximum traverse only two persons can stay in the compartment and they must both be on the side opposite the breech. The Howitzer fires semi-fixed ammunition with a four-zone propelling charge. At the maximum elevation which can be secured, 375 mils, as mounted on the carriage, zone four (muzzle velocity

1,250 fs) gives a range of 7,050 yards. It has a maximum depression of 120 mils and a traverse of 270 mils each side of center. When traveling at about 10 mph there is extreme pitching of the chassis, but this is greatly decreased when traveling at 18 to 20 mph.

The chassis of the artillery motor reel is the same as that of the T1E1 tank. It is engined with a commercial V-8 Cunningham motor of 90 BHP, has a maximum speed of 22 mph, carries 50 gallons of gasoline, 4½ gallons of oil, gets about 1¼ miles to the gallon, and weighs 15,580 pounds. It is equipped with a standard battalion reel which carries five miles of field telephone wire.

The ammunition carrier is on the same kind of chassis as the reel and weighs 15,000 pounds.

The bogie axle is designed as a carrier for a 75mm. gun when hauled behind a fast moving truck. It is equipped with pneumatic tires and weighs 1,500 pounds, empty.

Because the Mechanized Force, in addition to fulfilling its tactical role, must function as an experimental field laboratory, which will be progressively supplied with motor and mechanized equipment for test and development, it has of necessity, a great variety of vehicles. It is realized that at the present time many of them are unsuited for their purpose; and a sense of imagination has to be used, as is usually the case in the Army. However, all of the passenger cars, motorcycles, and cargo trucks are new. From the Artilleryman's viewpoint it is a pleasure to work with them after a decade spent in worrying over "wobblies", 1917 motorcycles, and ancient passenger cars.

In organizing the Mechanized Force, the War Department determined that something should be started without further delay, even if the design and manufacture of desirable vehicles had not yet approached the perfection desired. Perfection is seldom attainable in this world; and, in waiting for it, without a testing field laboratory, machines might be developed on wrong tactical lines. There is always the danger that we postpone indefinitely the choice of a model in the hope that tomorrow we will find something better than we have today.

TYPE PROBLEMS

Precision Lateral Problem

(See Par. 86, TR 430-85, 1930 Edition)

Target Description: Accompanying gun which has been neutralized. *Mission:* To be destroyed. *Type of adjustment:* Precision lateral (small T). *Materiel:* French 75mm. gun Model 1897. Visibility: Very good. Wind: Velocity 10 mph, direction R to L. Initial data: Deflection shift measured with field glasses, range estimated. Observer on the left.

$T=250$, $R=3.8$, $r=3$, $s=\frac{25}{3.8}=7$, $c=5$

$r/R=3/3.8=.8$, $s/c=7/5=1.4$, Fork=6.

Initial commands:

No. 1 adjust
Base Deflection Left 180
Shell Mk I, Fuze Long.
No. 1, 1 round
Quadrant 120

Commands	Elev.	Rd. No.	Deviation viewed at OP	Sensing Rn.	Sensing Def.	Remarks
	120	1	20 L	?		Deflection need not be sensed until fire for effect is started. To get on line .8×20=16.
Rt. 16	120	2	6 R	–		Factor of .8 is too large. Shift of 16 mils changed burst from 20 L to 6 R. New factor is 16/26=.6. To place last shot on line, go left .6×6=4. With estimated data a range bound of 4 forks is appropriate. 4 forks=24 mils. To keep shot on line go right 1.4×24=34. L 4 and R 34=R 30.
Rt. 30	144	3	Line	+		Split 34 mils deflection shift and 24 mils range bracket. The deflection shift of L 17 could have been determined as follows: shot No. 2 was 6 R, shot No. 3 was line, a shot fired half way bettween these two (L 15,132) should fall 3 R. 3×.6=2 to get it on line, L 15+ L 2=L 17.
Lt. 17	132	4	Line	–		Split 17 mils def. shift and 12 mils range bracket.
Rt. 8 (9)	138	5	3R	?		With regular terrain near target this would probably have been a line shot. .6×3=2.
Lt. 2	138	6	Line	+		This establishes 1 fork range bracket. Commence effect at trial elev. (center of bracket)
Lt. 3, 3 rds.	135	7	2 R	?(–)	?	Rds. No. 7 and 9 are sensed short on rule. Having sensed the first 3 as short, change elevation ½ fork in proper direction. Having sensed deflection short, improve deflection bracket.
		8	Line	–	–	
		9	2 R	?(–)	?	
Rt. 2, 2 rds.	138	10	Line	+	+	Rds No. 6 to 11 are assumed to have been fired at 136.5, giving 2 overs and 4 shorts. At this elevation fork =7 mils $\frac{4-2}{12}\times 7=1.2$.
		11	Line	–	–	
6 rds.	137.7		C. F.			136.5+1.2=137.7. Having sensed deflection over and short at the same setting, deflection is correct.

SUMMARY

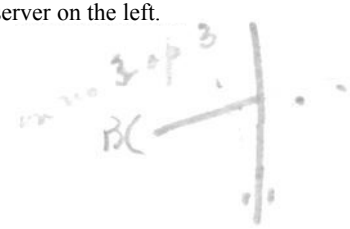
Errors in initial data: Deflection 34 mils; 1st shift in deflection 4 mils. Range 230 yards or 6%. Time from identification of target to announcement of 1st range 55 seconds. Average sensing and command 22 seconds. Total time for problem 7 minutes 10 seconds. Ammunition expended 11 rounds. Classification: Satisfactory. General comments: Procedure excellent, time very good.

Percussion Bracket Lateral Problem (Small T)

(See Par. 87, T. R. 430-85, 1930 Edition)

Target Description: Infantry assembling in slightly wooded draw 20 mils wide preparing to attack. Missions: Neutralize enemy and prevent attack. Materiel: French 75 mm gun Model 1897. Visibility: Good. Wind: None. Initial data obtained: Deflection Field glasses, range estimated. Observer on the left.

T=250 mils R=5 r=3
r/R=3/5=.6 s=25/5=5
Initial commands:
Base Deflection Left 120
Site—10
Shell Mk. 1, Fuze Long
No. 3, 1 round
5000.



Commands	Range	Rd. No.	Dev. as viewed from OP but not announced	Sensing Rn.	Sensing Def.	Remarks
No. 3, 1 rd.	5000	1	(25 Left)	?	?	25×.6=15. Right 15 is proper command.
Rt. 15	5000	2	5 Right	+	+	New r/R=15/30=.5
	4600	3	42 Right	?	?	Should have changed Deflection to stay on line 5×.5=2½ to get on line + (4×5) or 20 to stay on line. The command should have been "Left 20 (or 25) 4600" 42×.5=21 use 20
Lt. 20	4600	4	Line	–	–	
Rt. 10 Btry R	4800	5		?		No. 3, short on its part of target other pieces not sensible for deflection.
		6		+		
		7		–	–	
		8		+		
Rt. 5 On # 3, open 5. Btry. 1 rd. Zone	4700 4900					Open sheaf desired during effect. Command should have been "open 3."

SUMMARY

Errors in initial data: Deflection 10 mils: 1st Shift in deflection 5 mils; Range 200 yards or 4 per cent. Time from identification of target to announcement of 1st range 1 minute, 5 seconds. Average sensing and commands 12 seconds. Total for problem 6 minutes, 25 seconds. Ammunition expended 9 rounds. Classification: Satisfactory. General comments: Time: Good. Serious errors in problem were not shifting deflection to stay on line when firing round No. 3, and sheaf too wide in effect. Initial data: Excellent.

Time Bracket Lateral Problem (Small T)

Target Description: Infantry firing from the vicinity of a distinctive bush: Mission: To be neutralized. Materiel: French 75 mm gun, Model 1897. Visibility: Excellent. Wind: Velocity 15 miles per hour direction L to R. Initial data: Deflection shift measured with field glasses, range estimated. Observer on the left.

T=200, R=3, r=2.5, s=20/3=7

r/R=2.5/3=.8

Initial commands:

Base Deflection Right 220
Site+5
Kr. 35
No. 2, 1 round
3000

Commands	Range	Rd. No.	Dev. as observed (not announced)	Sensing Rn.	Sensing Def.	Remarks
No. 2, 1 rd.	3000	1	30 R	G ?		.8×30=24 Use nearest multiple of 5. Raise corrector.
Left 25, up 5	3000	2	3 R	A–	–	With estimated data a range bound of 4 forks is appropriate. 4×7=28 Rd. No. 2, was 3 R.
Right 25 Down 2 (3)	3400	3	Line	A–	–	First range bound not enough. 4×7=28 Use nearest 5.
Right 30 Down 2	3800	4	2 L	G+	+	Having split a corrector bracket of 5 pts. the corrector should not have been changed.
Left 15, Btry. Right	3600	5 6 7 8	12 R 5 R Line 9 L	A ? G + G+ G +	+	Height of burst of—2 is indicated. Bring in battery when splitting a 400-yard range bracket.
On No. 2 op. 4, Up 3, Btry. 1 rd.	3600		C.F.			Should have opened on No. 1, as Rd. No 7, being line over, shows positively that Nos. 1, 2 and 3 are to the right of adjusting point. Corrector too low should have ordered "Up S" based on last salvo. A 200-yard bracket with 100-yard sheaf for effect is appropriate, but should commence effect at 3400 where only 1 short was sensed instead of 3600, where 3 overs have been obtained.

SUMMARY

Errors in initial data: Deflection, 5 mils; Range 500 yards or 14 per cent. Time from identification of target to announcement of 1st range, 1 minute 10 seconds; Average sensing and command 22 seconds; Total for problem 5 minutes 10 seconds. Ammunition expended 8 rounds. Classification: Satisfactory. General comments: Corrector not properly handled, failed to obtain maximum effect. Time fair.

Time Bracket Lateral Problem

Target Description: Machine gun fire coming from vicinity of a fence corner inflicting losses on our Infantry. Missions: Neutralization, at once. Type: Time Bracket Lateral (small T). Materiel: French 75 mm gun Model 1897. Visibility: Excellent. Wind: 10 miles per hour from R to L. Initial data obtained: Deflection shift from Base Point measured with field glasses. Range estimated.

T=180 mils. r=2000 R=3000
Observer is on the left of the guns.
r/R=2/3 s=18/3=6
Initial commands:
Base Deflection Left 190
Site + 10
Corrector 35
No. 2, 1 round
3000

Commands	Range	Rd. No.	Dev. Observed but not announced	Sensing Rn.	Sensing Def.	Remarks
No. 2, 1 rd.	3000	1	45 Left	G ?	?	2/3×45=30
Rt. 30, up 10	3000	2	Line	A ?	?	
D 5	3000	3	5 L	A–	–	The deviation of 5 L is due to the corrector change, 400-yard range bound to be made, 4×6=24
Rt. 25, D 3	3400	4	10 L	G ?	?	Student failed to take into account the previous deviation of 5 L or to consider that he was moving the corrector still farther down. Right 30 would have been better. 10×2/3=7
Rt. 5	3400	5	Line	G +	+	Bring in battery when splitting 400 yards.
Lt. 15 Btry. Left	3200	6		A ?		
		7		A–	–	Ready to start effect.
		8		G–		
		9		A ?		
Rt. 10 On No. 2, open 4						Open sheaf desired during effect. (An equally good command would have been On No. 4 open 4). Height of burst was correct from previous salvo and required no change. Fire was started at the far limit to obtain verification of the single sensing.
Btry. 1 rd. Zone	3400 3200		End of Problem			

Errors in initial data: Deflection 55 mils; 1st shift in deflection 25 mils; Range 300 yards or 10 per cent. Time from identification of target to announcement of first range 35 seconds. Average sensings and commands, 9 seconds; Total time of problem 3 minutes 34 seconds. Ammunition expended 9 rounds. Classification: Satisfactory. General comments: The initial deflection and round No. 4 slowed the ploblem somewhat. Otherwise it was excellent.

THE HORSE AND MULE OUTLOOK

THE horse and mule outlook at the beginning of 1931 is but little different from that the beginning of 1930. The number of horses and mules on farms decreased further in 1930 and decreasing numbers are in prospect for the next few years. The colt crop of both horses and mules in 1930 was smaller than in 1929. The decline in the index of horse and mule prices in 1930 was less than the decline in the index of all agricultural products. While the use of power equipment on farms expanded in 1930, it is possible that lower purchasing power, lower wages, and cheaper work stock will tend to restrict this expansion in 1931.

The number of horses on farms January 1, 1931, was 12,803,000 head and the number of mules was 5,131,000 head, compared with 13,364,000 and 5,279,000, respectively, on January 1, 1930. The decline in mule numbers was particularly marked in some of the mule-producing states. There are no indications of a tendency to check the decline, since the number of both horse and mule colts raised in 1930 was less than the number raised in 1929. The total number of all horses and mules which was 25,000,000 in 1930 will be reduced to about 10,000,000 by 1940, providing births continue to present rates. Since the number of suitable breeding animals now on farms is greatly reduced, the maximum number of colts that could be raised from this breeding stock during the next 8 years could not prevent the total number of horses and mules from declining to 15,000,000 head by 1940.

Market and farm prices of both horses and mules for the United States during 1930 averaged materially lower than during 1928 and 1929, both of which were slightly above 1927. There was an upward trend in the farm values per head of all horses and mules during 1928 and 1929 in spite of the fact that old animals were a growing proportion of the total. This upward trend was checked in 1930 by the fall in the prices of horses and mules which accompanied the drop in the price level of farm products. Total receipts at key markets indicate only

slightly smaller receipts of horses and mules in 1930 than in 1929. Early season movement at these markets, however, exceeded that of 1929, but there was a drastic reduction in both numbers and prices during the latter part of the year. The sharp drop in numbers received during the three months, October, November and December, compared with the same period in 1929, reflect the greatly reduced farm purchasing power in the South and East. Shortages of feed and pasture were also factors in the smaller demand.

The inventory value of colts 1-year old but under 2 years on January 1, 1931, was generally lower in all sections of the country than on January 1, 1930, averaging for the United States about 15 per cent lower for both horse and mule colts. The 1930 inventory values were somewhat higher than the 1929 values for this class of colts in areas which normally buy their work stock.

The use of tractors, combined harvesters, and other power operated farm equipment continued to expand in 1930. On most farms which have been equipped with mechanical power, especially the larger farms, less dependence is being placed upon horses and mules for power. Even in the Southern States where the mule has always been the mainstay for field work, some shift to mechanical power is under way on the larger plantations. The generally reduced purchasing power of farmers in 1931 will probably tend to check temporarily the shift from animal to mechanical power.

The useful life of the old and the lighter horses is being prolonged both by tractors and trucks. Formerly draft animals were necessary for the heavy field operations and road hauling, much of which are now being done by mechanical power. The old and light animals are utilized for such operations as cultivating, haying and threshing, which are neither heavy nor of long duration.

Demand for horses and mules probably will not make much improvement during 1931 and prices should continue at present reduced levels. It is probable that an improvement in the agricultural situation in 1932 will be reflected in improved demand

and strengthening prices especially for mules. The comparative cost of mechanical power and of animal power and the available supply of work animals will be the determining factors in setting the limits to such upward movement.

The substitution of mechanical power for mules in the South will be relatively slow. There has been a sharp decrease in mule breeding in the States from which the cotton belt secures its work mules. Hence, a shortage of mules may develop within the next few years. Farmers who are in position to produce mules under favorable conditions probably will find a good market for young mules within the next four years.

PRINCIPAL SOURCES OF INFORMATION

Numbers, Horses, Mules and Colts.—Crops and Markets, February issues.

Census of Agriculture 1920, 1925 and preliminary 1930.—Bureau of Census.

Tractors on Farms.—Census of Agriculture, 1920 and 1925.

Birth rate of Colts—Crops and Markets, February, 1926.

Prices of Horses and Mules.—Crops and Markets.

Receipts at Markets.—Crops and Markets.

Numbers and Prices, previous to 1930.—Separate 1930 Yearbook.

POST WAR DEVELOPMENT OF THE 155mm. GUN, 8″ HOWITZER

By CAPTAIN ELMER C. GOEBERT, Ordnance Department

IN THE World War the United States Army employed two models of the 155mm. gun and two models of the 8″ Howitzer.

The 155mm. Gun Model 1917 was the French Grande Puissance Filloux while the 155mm. Gun Model 1918 was an American adaptation of the French design.

The 8″ Howitzer Model 1917 was the English Vickers Howitzer while the 8″ Howitzer Model 1918 was an American adaptation of the English design.

The following table gives the principal characteristics of these weapons:

	Weight of projectile in lbs.	Maximum Range in yds.	Maximum elevation degrees	Total traverse degrees	Weight of cannon and breech in lbs.	Weight of cannon mtd. on carr. in firing position	Weight of weapon in traveling position single load
155mm. Gun, M 1917.....	95	17460	35	60	8520	23660	28840
155mm. Gun, M 1918.....	95	17460	35	60	8715	25960	29410
8″ Howitzer, M 1917	200	10500	50	8	6555	19100	29540
8″ Howitzer, M 1918	200	13000	45	8	7500	20048	30490

The 155mm. Gun Model 1917 as illustrated in figures 1 and 2 clearly indicates the general design of the weapon. The Model of 1918 was identical with the Model 1917 except in certain minor points of design. The same is true when a comparison is made between the two 8″ Howitzer models so that it suffices to show but one of these weapons, Figure 3 illustrating the 8″ Howitzer Model 1917.

Both the 155mm. Guns and the 8″ Howitzers were classed as Army Artillery and held their place as such in the World War. They exemplified heavy loads in traveling and their mobility was seriously impaired since the wheel bearings and suspensions of the carriages were designed for use as horse drawn or slow artillery tractor draft vehicles. Their mobility, had it been

possible to apply high-speed draft to these weapons, would still have been impaired since the load in transportation was poorly distributed and required that careful study of bridge capacities be made wherever stream crossing had to be negotiated. As a result, in some cases long detours were necessary to place the weapons where they were desired.

The Westervelt or Caliber Board in its report, which was submitted May 23, 1919, recommended increases in range, traverse and elevations for the Army Artillery which, when comparison was made with the 155mm. Guns and 8″ Howitzers of the World War showed them to be so inferior in performance that they could only be classed as fair Corps Artillery weapons.

The Ordnance Department, in its studies resulting from the Caliber Board's recommendations, found that the forces on the carriage resulting from the ballistic requirements of the 155mm. Gun and the 8″ Howitzer as specified by that Board, were almost identical and proceeded with the design of a carriage to mount either the gun or the howitzer.

A new 155mm. Gun was designed which with a 95 lb. projectile had a maximum range of 26,000 yards. The weight of this gun was 9,200 lbs. A new 8″ Howitzer was at the same time designed and with a 200 lb. projectile had a maximum range of 18,000 yards and weighed 9,000 lbs.

The carriage designed to mount either of these two cannon was designated as the 155mm. Gun, 8″ Howitzer Carriage Model 1920E, and is illustrated mounting the howitzer in Figure 4 and mounting the gun in Figure 5. For the sake of comparison between these two views the howitzer exclusive of the breech is 200 inches or 16 feet 8 inches long, while the gun exclusive of breech is 274.7 inches or 22 feet, 10.7 inches long.

The following is a list of the general characteristics of the carriage and recoil mechanism.

Maximum elevation 65°
Total traverse 60°
Spring suspended, and hard rubber tired wheels
Tread width 88.5″
Weight exclusive of Cannon and Breech 18,800 pounds.
Filloux type Variable Recoil Mechanism
Maximum Recoil, Howitzer 71″, Gun 60″
Minimum Recoil, Howitzer 40″, Gun 24″

No attempt was made in this design to provide for greater traveling speed on the road since the possibility of application of high speed motive power to this type weapon had not as yet been realized, and it was intended that it would be drawn by the then existing slow speed artillery tractors.

The total weight of the carriage mounting the gun was 28,000 lbs. Again as in the World War types the bulk of the load was concentrated over one axle, as an examination of Figure 5 will show, and the difficulties experienced at stream crossings had not been eliminated. It was therefore proposed to remove the gun and breech mechanism from the carriage and carry it as a separate load for long road hauls involving stream crossings.

The Heavy Transport Wagon, Model 1920, shown in Figure 6 was designed to carry either the gun or howitzer. The tests of this accessory showed that while the purpose for which it was designed had been accomplished, its use in the field under service conditions was so unsatisfactory, due to difficulties of mounting and dismounting the gun, that it had to be discarded and an attempt made to obtain a more satisfactory solution.

The first result of this attempt is illustrated in figures 8, 9, 10, 11 and 12, which are pictures of a ½ scale wooden model built to demonstrate and study the principles involved in the design.

It was intended, as with the 1920 E Model, that for transportation involving bridge crossings, the weapons be divided into two loads. Figure 9 shows the carriage load while Figure 10 illustrates the gun or howitzer load.

The total weight of the carriage mounting the howitzer in firing position as illustrated in Figure 8 was computed to be 27,500 lbs. In order to equalize the two loads in travel, it was proposed to recoil the cylinders of the recuperator mechanism with the gun so that in splitting up the load for transportation they would become a part of the gun load. The recoil cylinder was placed below and the counter recoil cylinder above the gun.

The recoil and counter recoil rods were to be made fast to the bridge across the front of the cradle so that they could be readily released when the gun was removed from the carriage.

The gun proper provided the principal member for the transport

wagon. It was held fast to the rear axle by a jack yoke over the gun and tie rods which fastened the lugs on the front recuperator mechanism yoke. The top of the breech was slotted to receive a tow bar which, when locked in place, provided the eye which rested over the horn on the front bogie.

The design as a whole included many ingenious features and the proposed method of mounting and dismounting the gun was extremely novel. These features can best be brought out by a description of the procedure in removing the gun from the carriage.

Referring to Figure 9 it will be seen that the rear of the trails were provided with two run rails. To dismount the gun the trails were closed and locked. The upper half of the jack yoke A on the rear bogie Figure 12, was removed from the jack screws B by means of the two ratchet wrenches, one of which is shown at C. The rear bogie of the transport wagon was then rolled up on the rails and forward until it dropped down between the end of the rails and the rear of the cradle of the carriage and then forward under the cradle until it was up against the traveling lock seen under the cradle (Figure 9).

Two hand bogies illustrated at A, Figure 11, were next placed on the trails forward of the front end of the rails. The front bogie of the transport wagon was rolled into position at the end of the trails. The tow bar A, Figure 10, was then locked in place on top of the breech and a cable hook which ran to the tractor made fast to the eye B, Figure 10. The carriage was set at approximately zero elevation and the recoil and counter recoil rods released at their forward ends.

With this preparation the gun was ready to be pulled from the carriage. As it moved to the rear two men, one on each side of the trails, picked up one of the hand bogies, engaged it in a slot provided under the rear recuperator mechanism yoke and guided the flange wheels onto the rails. Another pair of men placed the other hand bogie in the slot under the front recuperator yoke and guided this bogie onto the rails. When the eye at the end of the tow bar was far enough to the rear, the front transport bogie was maneuvered to engage the horn C, Figure 10, in the eye. The movement to the rear was halted when a

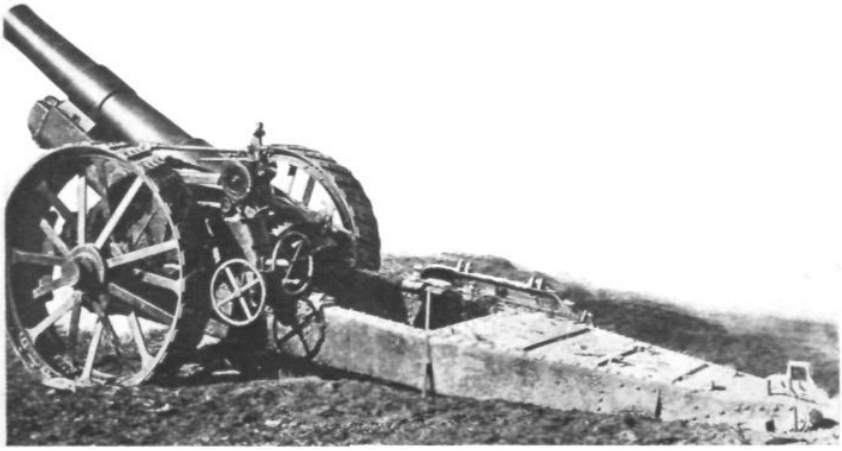


FIGURE 1. **155MM. GUN (G.P.F.) MODEL 1917 IN FIRING POSITION**
FIGURE 2. **155MM. GUN (G.P.F.) MODEL 1917 IN TRAVELING POSITION**
FIGURE 3. **8″ HOWITZER MODEL 1917**

locating band marked on the gun came opposite the space between the rear end of the cradle and the front end of the rails.

The rear bogie was next rolled out from under the cradle, the upper saddle of the jack yoke placed over the gun and the rear transport bogie jacked up off the ground and tight against the gun. The tie rods were then made fast.

The pull of the gun to the rear was then continued and in turn the hand bogies dropped from under the load and the rear transport bogies rolled down the ramps on the rear of the rails onto the ground.

While as previously stated the scheme was ingenious, a careful consideration of the above description and a study of the model lead to the belief that while it was possible to handle the model easily on level ground the problem would be somewhat different and extremely difficult when handling the 11,000-lb. gun and recupterator mechanism out on the field where unevenness of ground had to be contended with, which would distort the alignment of the rails and other elements of the structure and introduce probably many pitfalls.

The above descriptions bring the development of these items of Ordnance in point of time up to the summer of 1929.

Before continuing from this point it is desired to list some of the apparent disadvantages in the materiel which had been designed up to this time.

First: It was necessary to subdivide a 14-ton load into two loads for transportation which meant handling a weight ranging from 9,000 to 11,000 lbs. in the field.

Second: Crane or portable jack equipment of some form had to be provided to limber the carriage.

Third: The weight of the spades, which averaged from 500 to 600 lbs. each, made it almost essential to handle them by crane. See Figure 13, page 281.

Fourth: The wheel bearings had been designed for low-speed transportation due to the use of slow tractors as motive power.

Fifth: Twenty tons of material were required exclusive of motive power to make possible the transportation of a weapon whose ballistic characteristics required but 12 to 13 tons for stability if properly applied.

FIGURE 4. 155MM. GUN 8″ HOWITZER CARRIAGE M1920E WITH HOWITZER ON THE CARRIAGE

FIGURE 13. ARTILLERY TRACTOR EQUIPPED WITH BOOM AND CHAIN FOR HANDLING THE HEAVY SPADE USED WITH THE 155MM. GUN 8″ HOWITZER CARRIAGE M1920E

Sixth: When traveling short distances over fairly good roads the gun had to be retracted to release the excessive concentrated load on one axle.

Seventh: The limited resiliance found in the solid rubber tires, and the springs possible to apply in the type construction used, resulted in road shocks being carried into the upper structure which subjected the carriage to unnecessary wear and tear in travel.

With the development of engineering practices as we see them commercially applied today it was believed that it should be possible to eliminate all of these objectionable features.

In the early fall of 1929 studies of a carriage to be known as the 155mm. Gun 8″ Howitzer Carriage T2 were begun and the result of these studies is illustrated on page 283. The carriage is at present under construction and it is hoped will be completed by the end of the present calendar year.

When completed as shown in the picture, and including spades, traveling lock and accessories, it has been computed to weigh approximately 26,500 lbs.

The load has been distributed so that 18,000 lbs. will be carried on the forward truck which has two axles placed approximately 48″ apart. The balance of the load, 8,500 lbs. which includes the weight of the trail bogie, will be carried on the single axle at the end of the trails.

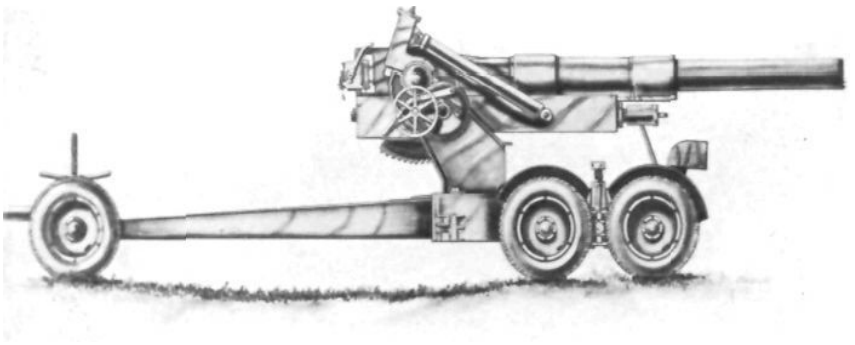
The forward truck has the flexible mounting so successfully used by some of the leading commercial truck manufacturers and will carry eight pneumatic tires each of which is capable of carrying a normal load of 4,000 lbs. with an overload rating of 6,000 lbs. The tires are mounted on quick demountable rims commonly used in commercial practice. The wheels are equipped with roller bearing with sufficient rating to permit road speeds as high as any commercial truck built today. The truck is further equipped with a commercial type of mechanical four-wheel brakes.

The trail bogie provides a 44° turning angle and carries two of the same size tires as the forward truck. Here again the wheels are roller bearing equipped.

The spade action in firing position is obtained through the use of four spades the sum total weight of which is 700 lbs., the heaviest weighing less than 200 lbs.

In firing position the bottom carriage rests upon the ground. The carriage is lowered to the ground by built-in jacks which are a part of the truck and bogie. No crane is necessary to handle any part of the carriage. Even the trails are picked up from the ground into a saddle and carried suspended under the axle instead of being picked up and placed over the axle as has been the practice in the past.

When in firing position but 2,000 lbs. (the weight of the trail bogie) will be removed so that instead of discarding approximately



155MM. GUN 8″ HOWITZER CARRIAGE, MODEL T-2, SHOWING THE 8″ HOWITZER IN TRAVELING POSITION ON THE LATEST MODEL GUN-HOWITZER CARRIAGE

30% of the travel weight but 8% will be removed since the four-wheeled truck remains as part of the stabilizing load in firing position.

The weapon will have an elevation of from 0° to 65° and 60° traverse, no recoil pit being required.

The first carriage built from this design will mount the 8″ Howitzer since it is desired to test the design under the most severe load.

As can be appreciated by those experienced and familiar with the use and handling of heavy mobile artillery, the results obtained with this carriage are being awaited with keen interest, since if they any way approximate what is anticipated, the effect of this type design will be far reaching in the entire field of mobile artillery.

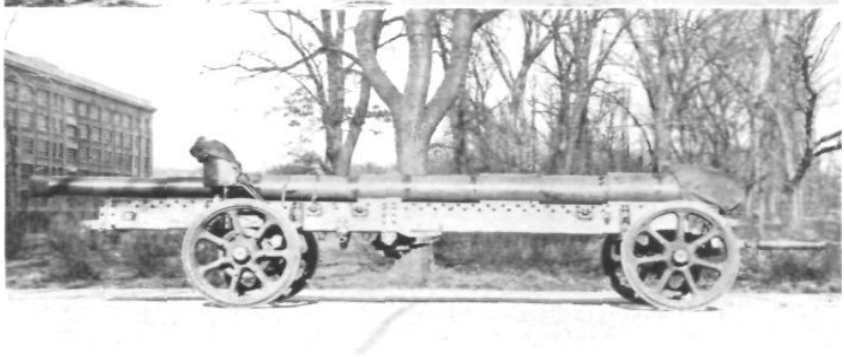


FIGURE 5. 155MM. GUN, 8″ HOWITZER CARRIAGE, M1920E

FIGURE 6. HEAVY TRANSPORT WAGON, M1920. SHOWING 155MM. GUN IN TRAVELING POSITION

FIGURE 7. HEAVY TRANSPORT WAGON, M1920. IN PLACE FOR MOUNTING 8″ HOWITZER ON CARRIAGE

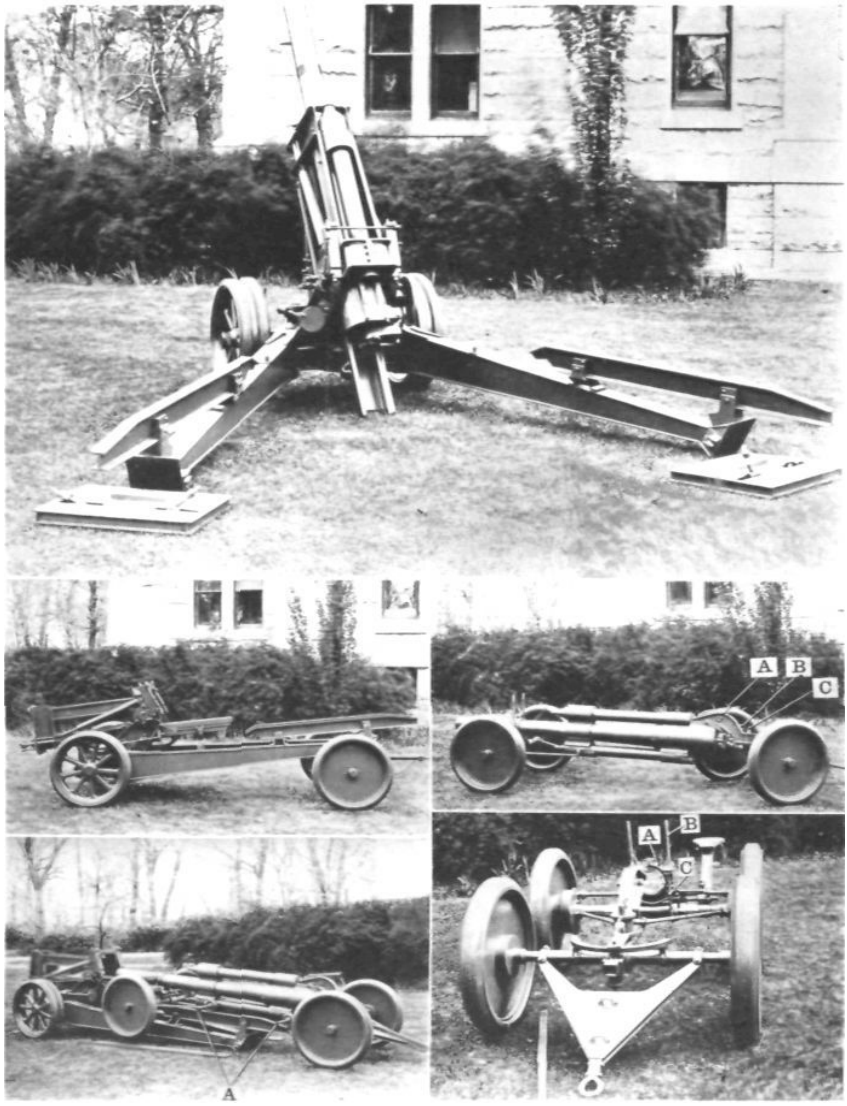


FIGURE 8. 155MM. GUN 8″ HOWITZER CARRIAGE, MODEL T-1, SOWING HOWITZER IN FIRING POSITION

FIGURE 9. (LEFT CENTER) 155MM. GUN 8″ HOWITZER CARRIAGE, MODEL T-1, SHOWING CARRIAGE, LOAD FOR TRANSPORTATION

FIGURE 10. (RIGHT CENTER) 155MM. GUN 8″ HOWITZER CARRIAGE, MODEL T-1, SHOWING GUN LOAD FOR TRANSPORTATION

FIGURE 11. (LOWER LEFT) 155MM. GUN 8″ HOWITZER CARRIAGE, MODEL T-1, LOADING GUN FOR TRANSPORTATION

FIGURE 12. (LOWER RIGHT) 155MM. GUN 8″ HOWITZER CARRIAGE, MODEL T-1, ELEMENTS OF GUN TRANSPORT WAGON

THREE VIEWS OF THE S.C.R. 131 SET

RADIO PROGRESS IN THE FIELD ARTILLERY

BY 1ST LIEUTENANT GEORGE F. WOOLEY, JR., F.A.

THE development of efficient, up-to-date radio sets for Field Artillery use having the desired characteristics of simplicity, ruggedness, small size, light weight, and portability is a slow process and a very difficult task owing to the many technical details involved. However, progress is being made in the Signal Corps Radio Laboratories at Fort Monmouth on our new sets and when they are finally approved by the Chief of Field Artillery, there will not only be radical improvement but also a much wider and more flexible use of radio communication in our Field Artillery organizations.

It is the purpose of this article to point out a few of the deficiencies of our present radio equipment, show why we should be issued modern equipment at the earliest practicable date, how it is intended that the new equipment and radio personnel contemplated in the F. A. Field Manual (to be published) be tactically employed, and lastly what changes we may reasonably expect as radio is improved to meet our special service conditions.

Almost thirteen years after the close of the World War, Field Artillery organizations have a barely workable minimum of radio operators and some heavy, cumbersome, old radio sets, obsolete in the light of present day development. They answered the purpose in days gone by, but tactics have changed, gun ranges increased, and we need a redistribution of up-to-date sets for modern conditions of warfare. It is said in the interests of economy we must continue to use obsolete equipment in the Service until the surplus war stocks have been exhausted. In the interests of economy a few months ago, several New York City radio dealers placed all the old radio sets they could find in one prodigious pile and burned them so that they would never be used or turned in to them again. If this idea would take root in governmental soil, how much more efficient would be army radio communication and how much faster this country's radio development.

We have had the curse of a vast surplus of VT-1 tubes which unquestionably are the least efficient of all the tubes used in army radio sets, and for which should be substituted the later type UX201A tube. The latter can be obtained from wholesale dealers for less than one-seventh the cost of the former tube as listed in Signal Corps supply catalogues, and its substitution in the present SCR 77-B loop set greatly improves the operation. There is increased amplification and considerable saving in the current consumption (drawing as it does only ¼ ampere as against 1.1 amperes for the VT-1) which is important where storage batteries have to be supplied in the field. Comparing the two tubes, we find the following:

Type	Filament Volts	Amperes	Plate Volts	"C" Bias	Amplification Constant	Price
UX201A	5.0	.25	90.0	4.5	8.0	$0.75
VT-1	2.5	1.1	45.0	1.5	6.5	5.45

Further remarks are unnecessary, it is believed, in this comparison.

Our present radio sets require one, three, or six storage batteries for proper operation, depending on whether the type is SCR 77-B, 79-A, or 109-A set. Although the Field Artillery is responsible for the efficient operation of its radio nets, it has no means of recharging its own storage batteries, but is dependent on the Division Signal Company for this service. If the Field Artillery brigade had a reliable portable charging unit to recharge its storage batteries, our present requirements could be promptly cared for without the delays incident to decisions affecting the general welfare of the division entering into the matter. Each present artillery radio set should in any event have three sets of storage batteries, one set in actual operation; a second fully charged reserve set with the radio to replace the first set at an instant's notice if necessary; and a third discharged set being recharged at the charging plant. When it is considered that each BB-29 storage battery weighs 35 pounds, it is

seen that weight becomes a serious problem in the field where transportation is limited. This storage battery bulk and the necessity for a charging plant has been eliminated in the new SCR 131 and 161 sets for the Field Artillery by furnishing with each set a hand generator weighing about 22¼ pounds complete.

The SCR 109-A, the principal radio set used at present by Field Artillery organizations, has several disadvantages. It consists of two rather cumbersome parts, a transmitter set box and a receiver set box, which require four interconnecting jumpers for ordinary field operation. Unnecessary for our purposes is the extra bulk and double panel space of this set with its many knobs and tuning devices which are the source of probably 60% of our radio troubles even with average operators. In using ICW, the buzzer furnished with the set has always given trouble, generally stopping sometime during an important transmission. A most satisfactory modification has been made at The Field Artillery School by substituting a motor alternator type GN-33 for the buzzer. The transmitter of this set can be tuned to only approximate accuracy. It is not as accurate as the SCR 79-A, for example, as the latter has a "Wave Length Adjustment" condenser in addition to the tapped inductance which acts as a sort of micrometer or fine adjustment. The SCR 109-A set complete with six spare BB-29 storage batteries weighs 580 pounds, too heavy a load in the field.

The SCR 79-A set might just as well be eliminated from our present scheme of radio communication and so will be only mentioned in passing. Since the Field Artillery brigade command post is generally with that of the division, there is no necessity for radio communication between these two units. If the artillery brigade ever desires communication with the other stations in the division radio net, it can be obtained by telephone, messengers, or by utilizing the division facilities, which are the hub of signal communication and always available.

The SCR 77-B is primarily an infantry set, but is used by the Field Artillery to communicate with the infantry battalions and regiments; also, until replaced, in the artillery liaison net. The SCR 131 has recently been approved by both branches to

replace the 77-B set. Chief among the difficulties experienced with the latter set is that of retaining proper calibration for any considerable period of time, especially over rough roads. The sets in a net sometimes have to be matched in order to operate properly, for the calibration of one set may differ so much as to render the operation of that set useless in conjunction with the others of the same net. The set is very sensitive to the effects of body capacity and any movement of the operators near the loop is communicated to the headphones. The loop connections give trouble unless they are kept bright and clean. Rain on an unprotected 77-B set will ruin transmission, reception, and very probably the set itself.

Trouble is also experienced, especially on the lower frequencies, in tuning sets with the wavemeters furnished as regular equipment with the SCR 109-A and 79-A sets. Recent tests here at The Field Artillery School indicate that the operation of a large number of nets composed of the SCR 109-A sets is only feasible when employed with some auxiliary method of tuning (using for example, a Corps master set) or with a more accurate but rugged wavemeter along the lines of the General Radio Company Wavemeter, type 174-D. Where this is done, the operation of our present 109-A ground nets with 15 kc. separation between nets is satisfactory in the case of CW, but there are not sufficient frequencies available for the ground nets of the artillery of a normal Corps. Where this is not done, ground nets overlap and cause needless interference.

At present, we have no adequate or proper means for transporting either the necessary number of radio sets and accessories or the radio personnel required in our Field Artillery organizations. The day when the spring wagon could be filled with heterogeneous men and equipment, spare wire, radio sets, etc., is past and we must adequately care for our expensive, technical equipment if it is to be in good serviceable condition when needed for communication purposes. The ambulance type radio wagons and radio trucks developed at this School are the best practical solution of the transportation problem offered as yet. In these vehicles are permanently installed antenna and counterpoise;

a loading coil, or variometer, which adds inductance to the inside antenna and permits tuning the set over the normal wave-length band obtained when using the regular outside V-shaped antenna furnished with the set; a shelf to support the radio set and act as a table for the radio operators extends across the inside of the vehicle just in rear of the front partition; two long box seats with hinged covers built lengthwise one against either side of the body containing seven storage batteries each (six for 109-A set, one for the 77-B set); a charging system for the radio truck batteries consisting of a standard Dodge 12-volt generator securely fastened to the left side of the GMC engine body allowing the spare set of batteries to be recharged when the engine is running; two six-volt bulbs in the ceiling to furnish illumination for the working operators; and switches to control the use of the inside or of the outside antenna if erected, and to cut in either bank of storage batteries as required. Such a radio vehicle provides transportation for one SCR 109-A set and one 77-B set, a driver or chauffeur, and five radio operators. Its tactical advantages are: (1) it permits operation of the radio net continuously while Field Artillery organizations are on the march; (2) it provides rapid installation of the radio station from march formation; and (3), it simplifies the rapid dismantling of the radio station and change to march formation. In a war of movement, communication at any time with airplanes is another important advantage. Good results have been obtained at Fort Sill between two radio wagons employing CW, ICW, and voice up to six miles (the limit of the test) at both the walk and trot; also good results were obtained between radio wagon and airplane using ICW and voice up to eight miles (limit of the test). Between a fixed ground station and a radio wagon moving at a trot, good results were obtained up to thirty miles using CW or ICW and up to twenty miles using voice. The actual practical limitation is unknown. It has been found that the apparatus is slightly directional, transmitting and receiving best in the direction of travel. Signal strength is materially affected by location in, or passage under, thick foliage or by passage through metal structures, such as a steel

truss bridge. Such radio vehicles should not be overloaded with extra men or additional sets or their purpose is defeated. The radio sets in use at present with equipment and spare batteries weigh approximately as follows:

SCR 77-B	(3 BB-41)	80 lbs.
SCR 79-A	(9 BB-29)	460 lbs.
SCR 109-A	(12 BB-29)	580 lbs.

The SCR 77-B set is conveniently carried under the operator's shelf in readiness to be set up outside near the command post upon arrival at a new position.

There is not at present the proper distribution between Field Artillery brigade organizations of radio sets or of radio personnel to properly meet modern communication problems. The Field Artillery brigade and regiment with three radio sets each have one too many sets; whereas the Field Artillery battalion with three sets has an insufficient number to function as it should. Let us see for a moment why this is true, also what radio sets we now have, what work they perform, and then what missions cannot be properly performed owing to lack of sets. To understand more clearly what follows, let us first compare the characteristics of our present three radio sets.

Scr Set	FREQUENCY IN KC		Range in Miles	General Description	Issued To:
	Tansmits	Receives			
77-B	4107 4409	4107 4409	5 (CW)	Loop set	2—Inf Regt 2—F A Regt 1—Inf Bn 2—F A Bn
79-A	273 600	273 600	20 (CW)	V-antenna	1—Inf Div 1—F A Brig 1—Inf Regt
109-A	600 999	273 999	60 (CW) 40 (ICW) 15 (Voice)	V-antenna. Air-ground and ground use.	1—Inf Div 1—Cav Div 2—F A Brig 1—F A Regt 1—F A Bn

A training memorandum from one of our Corps areas a year or so ago directed that all three of the above sets work in the same radio net during that particular training period and instructions were given to all concerned with regard to the simplified radio nets. Communications had become too complicated and were to be placed on a simpler, more efficient basis in this Corps Area, "by order." The author of this astounding training program failed to realize what is brought out in the above Table, that the SCR 77-B set is a short wave set operating on frequencies between 4107 and 4409 kilocycles (corresponding wave-lengths, 68 to 73 meters); that the SCR 79-A is designed purposely to operate in a different frequency band, that between 273 and 600 kc. (500-1100 meters); and that the SCR 109-A, to prevent interference with other sets when working in its proper band, is purposely designed to transmit on frequencies between 600 and 999 kc. (300-500 meters) and to receive on 273 to 999 kc. (300-1100 meters). What a mess radio communication would have been in this Corps had such an order been issued through ignorance in war! Fortunately it occurred during a peace time lull and the War Department promptly exerted its influence in having the astonishing new system revoked before it could be copied by any other Corps Area, or by any of the National Guard or Reserve organizations. How dangerous is a little knowledge!

Radio in the division Field Artillery brigade has at present a three-fold mission, which comprises: (1) means for working as a subordinate station in the division net; (2) means for operating a net control station in communicating with the three Field Artillery regiments in the brigade; and (3) means for communicating with airplanes and their ground station. At present, one SCR 79-A set takes care of the first mission, and two SCR 109-A sets are ample in number to take care of the other two requirements. If the brigade had one more radio operator, the radio staff sergeant would then be free to actively supervise the location and operation of all three sets instead of being tied down as a key operator, relief or helper in the installation of a particular set. The necessity for the 79-A set is open to question.

In the Field Artillery regiment, we now have two SCR 77-B sets and one SCR 109-A set. The former work one in each Infantry regimental net of a supported brigade and have small tactical advantage. Their elimination would work no hardship on anyone. From these underworked sets, let us pass to the SCR 109-A set which is just as badly overworked. This set is operated on one frequency in the artillery brigade net, on another frequency in the artillery regimental net, and sometimes on still another frequency with airplanes. This radio operator must be the best trained of any in the Field Artillery in order to tune his set to three different frequencies at stated times and clear his traffic with the minimum loss of time. How much better would it have been to have an additional 109-A set in place of the ornamental 77-B's, to share the actual work. To handle the three regimental sets we have been allowed one radio corporal and two radio privates in our war strength Tables of Organization (July 1, 1930). Whoever decided on the magical number three probably had no experience standing continuous watch as key operator and log operator combined for 48 hours or longer on field exercises, had never lugged storage batteries about the landscape in search of the perfect location to satisfy various critics, and had never set up by himself the regulation V-antenna or a radio set. Radical changes for the better will be observed when the new Tables of Organization appear in the near future. More about changes in the radio personnel later.

In the light battalion of division artillery, tactical considerations continue to demand an increased and an improved use of radio to supplement long wire circuits. The battalion has need of radio in the following cases: (1) to communicate with the artillery regiment and its other battalions; (2) to communicate with airplanes in the adjustment of fire; (3) to communicate with the supported Infantry regiment and battalion; (4) to maintain communication with the artillery liaison officers with Infantry assault battalions, wherever they may go. The present number of sets in the battalion is three, i. e., one SCR 109-A and two SCR 77-B sets. The 109-A is used in cases (1) and (2) above; one 77-B set works on one tuner setting in the Infantry regimental

net, and on another tuner setting as net control station in the artillery liaison net with the other battalion 77-B set (a pack set usually assigned to one of the liaison sections). It is very poor tactics indeed, but under the present arrangement the NCS must break communication with the artillery liaison set in order to report at stated times into the Infantry net. Efficient operation of the artillery liaison net demands a separate frequency on which to work and the freeing of the NCS from additional work in the Infantry net. Moreover, where there are two Infantry battalions instead of one in the front line, a common case, one artillery liaison section will be without radio. To properly take care of cases (3) and (4) above, two additional sets (one a pack set) of the portable, loop type should be given the artillery 75-mm. battalion with four operators to care for them. In this case, one artillery 77-B set will work only with the Infantry, and the other three 77-B sets will form the artillery liaison net. The radio pack sets can then be definitely assigned, one to each liaison section. At present, the one radio pack set with the detail is not assigned to either liaison section, hence it is generally overlooked by the battalion commander in his order. The present battalion radio personnel consisting of one radio corporal and two privates is insufficient. The number should be and will be increased when the new proposed Tables of Organization are released. We should have a key operator and a log operator with each set and a staff or technical sergeant to act as chief radio sergeant, who will be responsible for the location and operation of all sets and the proper training of operators in the organization.

Efficient radio operators cannot be trained overnight. In a major emergency, we can expect to find available but a very few of the trained operators that we need. It is just as much of a fallacy to believe that the many short wave enthusiasts ("hams") in this country can step right in as army radio operators in the event of war as it was to believe at the beginning of the World War that one million soldiers would spring to arms overnight. Some can do it, but the majority will find that not only are army radio sets handled differently, but that our radio procedure must

be practiced diligently before it can be thoroughly learned. Whereas many amateurs transmit in the clear at less than ten words per minute, trained army operators transmit cryptographed messages at speeds ranging from fifteen words per minute on up. Most amateurs would be lost in army nets until they had had months and months of training with our operators. When the number of regular army radio operators is below the minimum required, and no warrants or ratings are available as an inducement for hard work, small wonder that the buck private often reports that the radio doesn't work. With new equipment, and the specialists' ratings shown in a later table, the improvement in radio communication should be nothing short of marvelous.

Radio functions properly in Field Artillery organizations of our Service today only when it is placed in charge of well trained radio operators who are familiar with the idiosyncrasies of our obsolete equipment and make it work. How much better would it be were this energy to be expended in testing, trying out and learning the limitations of the latest equipment, such as the SCR 131 and SCR 161 radio sets, so that in case of war we would have the benefit of experience under varied service conditions of the latest modern sets rather than of sets ten or fifteen years old. No stone should be left unturned in keeping abreast of the latest radio developments, for in wars of the future the lives of men will depend on the efficiency of radio as a signal agency. In the Field Artillery, radio is becoming daily more indispensable, and who knows but that it may in the end supersede the telephone as the primary means of communication? If constantly improved as it should be under service conditions during peace times, and our radio operators trained with the future possibilities of radio in mind, a great many of the problems of Infantry-Artillery liaison, airplane adjustment of fire, etc., will be ironed out before another war catches us unprepared as usual.

Mention has been made of the contemplated changes in radio personnel in Field Artillery organizations which will appear eventually in new Tables of Organization. It is interesting to note the progress shown by these changes in comparison with

what we have at present. The following Table is self explanatory.

RADIO PERSONNEL IN FIELD ARTILLERY UNITS

Tables of Organization 1930				Contemplated Changes in T. of O.					
Grade	Brig	Regt	Bn	Brigade		Rgt		Bn	
	W	W	W	P	W	P	W	P	W
Tech. Sgt.	—	—	—	—	1	—	1	—	—
Staff Sgt.	1	—	—	1	—	1	—	—	1
Sergeants	—	—	—	1	3	3	3	2	3
Corporals	1	1	1	—	—	—	—	—	—
*Pvt. Sp. 3″ Cl.....	—	—	—	2	3	3	3	2	3
*Pvt. Sp. 5″ Cl.....	—	—	—	2	3	3	3	2	3
*Privates	4	2	2	—	—	—	—	—	—

*NOTE: May be Private or Private 1st Class.

The distribution of radio operators between organizations is still seen to be faulty unless changes are made after this article goes to press. Contemplated changes call for three radio sets (1 SW 109, 1-61, and 1-171) in brigade, two SCR 161 sets in regiment, and six sets (1 SW 109, 1-131, and 4-161) in battalion. During peace times, the brigade will have six radio operators and in war ten radio operators to handle three sets which is fair, although the addition of one more peace time operator would be better so as to release the chief radio sergeant for general technical responsibility and supervision of all sets rather than tying him down to one set. The regiment needs a minimum of five radio operators including a chief radio sergeant to work its two sets, but has been given ten operators, a generous supply. The battalion has been given only six peace time and ten war time radio operators to work its six sets, which is of course an insufficient number of operators. The battalion ought to have thirteen operators including a chief radio sergeant. It takes just as many radio men to set up and take down a set and work reliefs as key operators and log operators in peace times as it does in war, the only difference being in the increased mental and physical strain on the operator during war. It would be desirable

to have three or more operators per set in time of war to permit immediate replacement of casualties, etc. During peace times, the number should not be reduced below the minimum efficient working basis of two men per set with a chief radio sergeant responsible for technical details in the operation of all sets in the organization.

Now let us consider the contemplated new Field Artillery radio sets and compare their characteristics as shown in the following Table with those shown in the previous Table of present day radio sets:

SCR Set	Frequency in KC		Range in Miles	General Description	Issued To:
	Transmits	Receives			
171 (Contemplated)	2640 3040	2640 3040	15 (CW)	L-antenna	1—F A Brig
SW 109 (Contemplated)	3000 4000	3000 4000	60 (CW) 40 (ICW) 15 (Voice)		*1—F A Brig 1—F A Bn
131 (Approved)	3960 4360	3960 4360	15 (CW)	Loop set	1—Inf Brig 2—Inf Regt 1—Inf Bn 1—F A Bn 75mm
161 (Under development)	4370 5100	4370 5100	15 (CW)	Loop set	1—F A Brig 2—F A Regt 4—F A Bn 75mm 1—FA Bn 155mm

*Under consideration.

Note that all the new sets are to work on short waves in the vicinity of our present 77-B band. This will obviate the interference in our present nets caused by high power radio broadcast and other stations operating on the higher wavelengths. The SW-109, if adopted as it stands, will overlap by 40 kc. the bands of the SCR 131 and 171 which is immaterial, except that in a special case it may reduce by one frequency the frequencies assigned to division, or to Infantry brigade, or to Infantry regiment. The frequency bands of the SCR 131 and 161 sets are separated by 10 kc. to prevent interference and to permit full use to be made of all settings on each set. The range in miles of the loop sets has been increased materially over that of the SCR

77-B; and that of the 171 reduced slightly in comparison with the 79-A. The SCR 171 is also to have an L-antenna instead of the V-antenna furnished with the 79-A.

The SCR 131 set, recently approved by both the Field Artillery and Infantry, is designed to be easily portable by two men. The total weight of the set is about 65 pounds, which is less than the weight of two BB-29 storage batteries, each weighing 35 pounds. The radio receiver and transmitter with forty practicable tuner settings, employing two VT-5 tubes in the receiver, one VT-2 tube for the transmitter, consists of two wood boxes permanently hinged together and closed for transportation by two hooks one on each side. Two No. 6 dry cells supply the receiver filaments and two BA-2 batteries the plate circuit. Complete with batteries, headsets, and tubes, the boxes weigh 23 pounds, and when closed are 13-1/32 inches high, 12-21/32 inches wide, 8-1/32 inches deep. The loop, weighing 2½ pounds, consists of four lengths of square brass tubing, two pairs being permanently hinged together. Each half of the loop plugs into sockets on the back of the set box, and the two halves snap together in a knife switch contact at the top of the loop. A hand generator, weighing 22¼ pounds complete with three removable legs (one of which carries a seat for the man operating the generator) and crank, furnishes power for the transmitter tube filament and plate circuit. It is a low voltage generator developing 8.4 volts at the brushes with 7.5 volts at the VT-2 tube terminals in the set box, and has a voltage regulator adjusted to maintain this voltage for all crank speeds above 50 R.P.M. The field winding connected across the low voltage armature provides the excitation for the high voltage armature which is rated at 350 volts, .03 ampere. Two carrying bags are furnished: one bag for the loop, the three legs of the hand generator, and the two crank handles; the other bag to carry two spare No. 6 dry cells, two spare BA-2 batteries, one spare VT-2 tube, the generator cord connector, field message books, etc.

The new radio nets will function as shown in the accompanying Figure. When the new sets are issued, Field Artillery brigades and regiments will have sufficient sets to take care of all

radio traffic under conditions of present day warfare. The battalions of light artillery with their six sets will also be able to function a great deal more satisfactorily than at present. The howitzer battalions need only two sets, the SCR 161 and SW 109, to accomplish their mission. By comparing the diagrams of the new and the old radio net operation, it is seen that a much broader and improved use can be made of the new radio equipment when, as, and if issued over that in service today. Especially, if the SCR 161 sets were to be issued to the Service, it is believed that many troublesome artillery battalion communication problems would vanish.

What radio development may we look forward to in the future for our arm of Service? Certainly it is impossible to forecast that definitely during the present day whirlwind progress in radio technique. At any time, some precocious inventor may startle the world with a new set or new device which will revolutionize the industry. The Field Artillery may have eventually one basic set with plug-in coils to replace all the various and sundry sets which we now have or it is contemplated that we have. We may eventually reduce the weight component to such an extent that our sets may be carried by radio personnel on foot or on horseback much as is the EE-5 telephone at present. Perhaps the battery commander at the observation post, the reconnaissance officer at a forward observation post, and the executive at the guns may communicate directly with each other at any itme by means of some light miniature set strapped to them with its antenna a part of their helmet. Lightning rods may again come into their own, this time as a part of what the well dressed battery officer shall wear as antenna equipment! In adjustments using airplane observation, the observer of the future may communicate directly with the battery executive or his radio operator at the gun position instead of through the medium of the battalion radio station. When enemy airplanes are sending down tons of bombs and aerial torpedos and it is impossible to maintain our wire communication in the face of the heavy bombardments of the future, radio may be our only salvation. Who can tell?

POLO

ARMY POLO ASSOCIATION HANDICAPS

(Revised January 22nd, 1931, and published by the U. S. Polo Association. Total number of Army Polo players listed is 1383, of whom 400 are Field Artillerymen. The Field Artillerymen are in italics).

Abbott, Capt. O. B. 0
Adair, Capt. H. 0
Adams, Lt. H. P. 0
Adams, Capt. John C. 1
Adams, Lt. J. C. L. 0
Adamson, Capt. H. 0
Adler, Capt. E. E. 0
Airan, Lt. Jesus 0
Alderman, Lt. C. 0
Alexander, Lt. H. M. 1
Alexander, Maj. W. D. 2
Allen, Capt. C. J. 1
Allen, Capt. F. A. 0
Allen, Capt H. B. 2
Allen, Capt. H. T., Jr. 0
Allen, Capt. R. R. 0
Allen, Maj. T. de la M. 3
Almquist, Capt. E. H. 0
Aloe, Capt. R. C. 1
Alverson, Capt. J. L. 0
Amazeen, Lt. C. P. 0
Amory, Maj. C. B. 1
Anderson, Lt. H. 0
Andrews, Lt. E. L. 0
Andrews, Maj. F. M. 1
Andrews, Maj. G. S. 1
Applegate, Lt. E. C. 0
Argo, Capt. R. W. 0
Arnold, Maj. A. V. 2
Asensio, Lt. M. J. 0
Atwell, Capt. R. N. 0
Babcock, Lt. C. S., Jr. 0
Babcock, Lt. D. S. 1
Baehr, Maj. C. A. 3
Bailey, Lt. G. W., Jr. 0
Baird, Lt. A. R. 1
Baird, Maj. H. W. 1
Baker, Lt. H. E. 1
Baker, Lt. H. D. 3
Baker, Lt. J. K. 2
Baldwin, Capt. R. O. 0
Baldwin, Lt. T. A., Jr. 0
Ballantyne, Lt. J. L. 0
Barden, Lt. A. R. S. 3
Barks, Lt. Louis 0
Barnes, Lt. V. B. 0
Barnes, Lt. W. H. 0
Barnhart, Capt. F. H. 2
Barrett, Lt. Chas. J., Jr. 1
Bartlett, Lt. W. H. 2
Batson, Maj. R. C. 1
Bawmann, Lt. J. H. 0
Bauskitt, Capt. W. J., Jr. 0
Baylies, Capt. A. L. 1
Beal, Lt. O. L. 2
Beasley, Capt. R. W. 0
Beaucond, Capt. C. A. 2
Beck, Lt. D. A. 0
Beeman, Capt. H. N. 1
Beiderlinden, Lt. W. A. 1
Bell, Lt. Clyde B. 0
Bell, Col. Ola W. 0
Bender, Capt. J. D. 2
Bennett, Lt. A. G. 0
Bennett, Lt. C. W. 0
Benney, Capt. J. F. 1
Bennison, Lt. R. T. 0
Benson, Lt. G. C. 4
Berg, Lt. C. E. 2
Berg, Capt. S. 1
Berry, Lt. L. C. 0
Bertholet, Capt. F. E. 0
Besse, Capt. A. H. 1
Betcher, Maj. A. J. 0
Bethel, Lt. J. M. 1
Betts, Capt. E. C. 2
Bevan, Capt. W. L. 1
Beverly, Lt. G. H. 2
Biddle, Lt. W. S. 1
Bidwell, Lt. B. W. 0
Biggs, Capt. L. W. 0
Billingsley, Lt. C. A. 0
Billingsley, Lt. J. D. 0
Bing, Lt. R. C. 2
Bird, Lt. J. F. 0
Bixel, Lt. C. P. 0
Black, Lt. J. W. 0
Blakeney, Lt. C. C, Jr. 0
Blakeney, Lt. C. G. 1
Blatt, Capt. R. C. 0
Bloomquist, Capt. G. F. 0
Blue, Capt. J. W. 2
Blunt, Maj. W. M. 1
Boatner, Lt. Harry W. 0
Boon, Capt. Stephen 0
Booth, Lt. C. L. 0

Booth, Lt. M. B. 1
Born, Lt. C. F. 0
Bosserman, Lt. R. B. 2
Boucher, Capt. F. H. 0
Boudinot, Capt. T. E. 0
Bowley, Maj. F. W. 2
Boye, Maj. F. W. 1
Boyers, Capt. J. A. 3
Boykin, Capt. J. G. 1
Boyle, Capt. C. E. 2
Bradford, Lt. D. E. 0
Bradford, Capt. W. B. 0
Bradley, Lt. J. S. 1
Bradley, Lt. W. J. 0
Brandt, Lt. C. A. 2
Brady, Lt. B. W. 0
Brann, Lt. D. W. 1
Brannan, Maj. F. M. 0
Branson, Capt. H. L. 1
Bratton, Lt. D. H. 0
Bratton, Maj. R. S. 0
Brendon, Lt. J. P. 0
Brennan, Lt. T. J., Jr. 0
Brewer, Maj. C. 3
Brewster, Lt. M. W. 0
Brian, Capt. A. R. 0
Bridges, Capt. B. C. 2
Bridgeman, Lt. R. H. 0
Brill, Lt. Albert 0
Brimmer, Lt. H. W. 0
Briscoe, Maj. N. B. 0
Brittingham, Lt. G. L. 0
Broaddus, Capt. K. 0
Broedlow, Lt. R. W. 0
Bromley, Lt. C. V. 1
Brooks, Capt. C. T. 0
Brooks, Capt. E. F. 1
Brooks, Capt. E. H. 0
Browder, Lt. W. F. 1
Brower, Maj. G. W. 0
Brown, Capt. E. H. 1
Brown, Lt. H. H. 0
Brown, Maj. J. K. 4
Brown, Lt. Col. Lewis, Jr. 4
Brown, Lt. P. W. 0
Brown, Maj. T. K. 1
Browne, Lt. J. C. 1
Brownell, Lt. J. R. 0
Bruner, Lt. A. P. 0
Bruner, Lt. G. E. 1
Bruton, Lt. P. G. 0
Buckland, Lt. D. P. 1
Buckley, Capt H. A. 1
Buckley, Lt. M., Jr. 1
Buechler, Capt. T. E. 2
Bulger, Capt. J. W. 0
Bullard, Maj. P. C. 1
Bunnell, Lt. F. H. 0
Burback, Lt. C. F. 0
Burcham, Lt. C. A. 0
Burdge, Lt. J. M. 0
Burgess, Capt. C. 2
Burgess, Capt. D. 3
Burgess, Lt. H. F. 0
Burgess, Lt. W. M. 0
Burkhart, Lt. E. C. 0
Burleson, Lt. Col. R. C. 0
Burnett, Lt. E. M. 1
Burns, Lt. J. J. 1
Burnside, Lt. Walter 0
Burress, Capt. W. A. 1
Burritt, Lt. G. E. 2nd 1
Burt, Capt. W. C. 1
Busbey, Lt. George 2
Bush, Lt. J. K. 0
Butler, Lt. F. B. 0
Butler, Lt. Lawton 1
Byerly, Capt. F. S. 0
Byers, Lt. C. E. 1
Byrd, Capt. C. B. 1
Caffey, Lt. B. F. 0
Caldwell, Capt. G. L. 1
Cameron, Capt. H. H. 1
Camp, Capt. H. E. 0
Campbell, Lt. W. P. 0
Cannon, Capt. V. M. 3
Caperton, Maj. J. N. 2
Carleton, Lt. Don E. 0
Carmouche, Lt. G. H. 0
Carpenter, Lt. G. R. 0
Carroll, Lt. J. V. 0
Carson, Capt. M. 1
Carter, Lt. L. D. 0
Carter, Lt. P. D. 1
Carter, Lt. R. A. 0
Catalan, Lt. N. 0
Causey, Lt. L. 0
Cavanaugh, Lt. A. A. 0
Cella, Lt. J. A. 0
Chaffee, Lt. Col. A. R. 2
Chaffee, Lt. F. H. 0
Chamberlain, Lt. J. L. 0
Chamberlain, Maj. H. D. 4
Chandler, Maj. C. P. 3
Chandler, Lt. R. E. 0
Chaney, Maj. J. E. 0

Chapin, Maj. F. K. 1
Chapman, Lt. C. P. 2
Cheshire, Capt. H. H. 0
Cheves, Capt. G. X. 2
Childs, Capt. F. M. 0
Clark, Lt. C. H. 0
Clark, Maj. C. L. 2
Clark, Capt. S. F. 1
Claussen, Lt. Geo. C. 0
Clay, Lt. R. P. 2nd 1
Claybrook, Lt. J. H., Jr. 2
Clendenen, Lt. C. C. 0
Clifford, Maj. C. L. 2
Clover, Capt. George 0
Cloverdale, Lt. G. B. 0
Clyburn, Lt. J. W. 3
Coe, Maj. R. L. 1
Coiner, Capt. B. H. 0
Cole, Capt. C. B. 0
Cole, Capt. J. T. 2
Collier, Lt. J. H. 0
Collier, Capt. W. A. 1
Collins, Lt. J. F. 0
Collins, Maj. James L. 2
Colwell, Capt. J. K. 0
Comfort, Lt. F. 1
Condon, Lt. R. 1
Conlon, Lt. C. L. 1
Connally, Lt. W. P. 0
Connell, Lt. S. M. 2
Conrad, Lt. G. B. 1
Constant, Maj. S. V. 0
Cook, Capt. J. G. 0
Cooksey, Capt. R. W. 1
Coombs, Lt. R. H. 0
Cooper, Lt. R. C. 0
Corlett, Maj. C. H. 0
Cornog, Lt. W. W. 0
Corridon, Lt. J. H. 2
Cort, Lt. Hugh 2
Coughlin, Lt. W. L. 0
Coulter, Capt. H. K. 4
Coulter, Maj. J. B. 1
Counihan, Lt. T. J. 0
Coverdale, Lt. G. B. 0
Covey, Lt. P. R. 1
Cox, Capt. C. R. 0
Cox, Lt. J. W., Jr. 0
Craig, Capt. Charles 0
Craig, Lt.-Col. D. F. 1
Craig, Capt. R. E. 2
Craig, Capt. W. H. 3
Cramer, Capt. Charles 0
Cramer, Capt. L. V. 0
Crane, Capt. D. L. 2
Craw, Lt. D. T. 3
Crawford, Lt. H. 1
Creary, Lt. J. H. 0
Creed, Maj. R. L. 2
Creel, Capt. B. M. 0
Crehan, Lt. J. P. 1
Crittenberger, Maj. W. D. 1
Crockett, Capt. G. K. 1
Crowe, Lt. W. J. 1
Culberson, Maj. W. L. 0
Cullinane, Capt. D. B. 0
Cullen, Maj. F. L. 0
Cullins, Lt. H. 3
Cullum, Maj. E. G. 1
Culton, Lt. H. G. 3
Cunningham, Capt. J. W. 1
Curtis, Capt. C. S. 0
Curtis, Capt. Ivan 0
Curtis, Lt. R. W. 1
Cutler, Lt. A. W. 1
Daly, Capt. J. 0
Daly, Lt. J. B. 0
Daly, Maj. J. O. 1
Danforth, Capt. G. L. 0
Daniels, Capt. E. M. 1
Darrell, Lt. R. H. 0
Dasher, Lt. C. L. 1
Davidson, Lt. J. A. 0
Davies, Lt. T. H. 0
Davis, Capt. C. E. 4
Davis, Capt. J. F. 1
Davis, Maj. Robert 1
Davis, Capt. W. D. 0
Davison, Lt. H. W. 0
Davison, Maj. P. R. 1
Dawley, Maj. E. J. 1
Dean, Lt. R 0
Dean, Capt. W. H. 1
Dean, Lt. W. F. 0
DeBardeleben, Lt. D. 1
De Graaf, Lt. G. 1
DeLangton, Capt. F. C. 1
Delany, Lt. N. J. 1
DeLong, Capt. J. C. 1
Delorimer, Capt. A. 1
Dencker, Lt. W. L. 1
Derrick, Maj. J. D. 0
Deepland, Capt. L. A. 0
Devers, Maj. J. L. 3
Devine, Lt. M. A. 3
Dewey, Lt. F. O. 1

Dewey, Lt. L. R. 0
DeWitt, Maj. C. 1
Diehl, Capt. J. W. R. 0
Dierking, Capt. I. S. 0
Dill, Capt. L. C. 0
Disney, Lt. P. A. 0
Dissinger, Capt. C. E. 2
Doan, Lt. L. L. 0
Dobyns, Capt. T. A. 0
Dockler, Capt. J. 0
Dodd, Lt. F. T. 2
Dodd, Capt. Haywood S. 0
Dodge, Lt. C. S. 0
Dodge, Capt. H. E. 1
Donahue, Capt. J. H. 0
Donaldson, Lt. R. H. 0
Donaldson, Lt. F. Q., Jr. 3
Donnovin, Lt. J. P. 1
Doran, Capt. A. F. 1
Dorst, Maj. J. A. 1
Dosher, Capt. G. H. 1
Douglas, Capt. J. S., Jr. 0
Douglass, Lt. R. W. 2
Downer, Lt.-Col. J. W. 1
Doyle, Lt. E. J. 0
Doyle, Lt. J. P. 0
Drake, Lt. R. A. 0
Draper, Lt. H. P. 0
Drummond, Lt. W. H. 1
Duff, Capt. R. E. 0
Duffy, Lt. I. A. 1
Dugan, Lt. A. D. 0
Duke, Capt. J. T. 1
Dukes, Capt. E. F. 1
Dulaney, Lt. R. L. 2
DuLong, Capt. 0
Duncan, Lt. H. W. 0
Dunckle, Capt. W. C. 0
Dunn, Lt. T. W. 0
Dupuy, Capt. R. E. 0
Eager, Maj. J. M. 1
Earnest, Capt. H. L. 1
Eastwood, Capt. H. E. 0
Eckert, Lt. H. D. 1
Eckert, Lt. J. P. 1
Eddleman, Lt. C. D. 0
Edmondson, Lt. E. M. 1
Edmunds, Lt. J. B. 0
Edmunds, Maj. K. B. 0
Edwards, Lt. R. 0
Edwards, Lt. S. 0
Ehrhart, Lt. G. V. 0
Elkins, Lt. J. W. 1
Elkins, Lt. S. B. 1
Elliott, Lt. H. G. 1
Ellis, Maj. E. de T. 1
Ellis, Capt. Murray 0
Ellis, Capt. R. B. 0
Ellsworth, Lt. R. A. 0
Elms, Lt. G. C. 1
Elwood, Lt. Ernest A. 1
Englehardt, Lt. E. C. 0
Ennis, Lt. W. P., Jr. 0
Erlenkotter, Maj. H. 1
Erskine, Lt. David G. 1
Ervin, Capt. R. G. 2
Esterday, Maj. G. W. 0
Estes, Maj. H. M. 1
Eubank, Lt. E. L. 1
Evans, Lt. I. K. 0
Evans, Lt. J. P. 1
Evans, Lt. R. B. 0
Ewen, Capt. Lloyd C. 0
Fadness, Lt. A. G. 0
Fain, Col. J. S. 0
Fainter, Capt. F. F. 0
Fake, Lt. C. W. 0
Falck, Capt. W. A. 1
Farmer, Lt. C. R. 2
Farrell, Lt. F. W. 0
Farwick, Lt. H. W. 0
Faulkner, Col. A. O. 0
Feagin, Lt. C. W. 3
Featherstone, Capt. H. E. 0
Febiger, Capt. P. C. 1
Fellows, Lt. F. E. 0
Fellows, Capt. H. C. 0
Fenton, Capt. M. T. 0
Ferrand, Lt. E. G. 0
Ferrin, Capt. C. S. 1
Fickett, Capt. E. M. 0
Finley, Capt. Glenn S. 2
Finley, Capt. J. R. 0
Field, Lt. L. O. 1
Fish, Lt. J. 1
Fisher, Lt. S. H. 0
Fiske, Capt. N. E. 2
Fitch, Lt. B. M. 2
FitzGerald, Capt. H. J. 1
Fleming, Maj. P. B. 1
Fleming, Capt. P. C. 3
Fletcher, Lt. L. S. 0
Fletcher, Lt. W. T. 0
Floyd, Lt. R. B. 0
Fooks, Lt. N. I. 0
Forbes, Lt. W. R. 0

Ford, Lt. W. W. 0
Forde, Lt. H. M. 0
Forster, Capt. H. W. 0
Forsyth, Lt. A. E. 2
Forsythe, Capt. J. D. 1
Foster, Capt. Harry 0
Foster, Lt. I. L. 0
Foster, Lt. R. T. 0
Fowler, Lt. H. C. 0
Fox, Capt. A. P. 1
Foy, Capt. L. W. 0
Foy, Col. R. C. 0
Frakes, Capt. E. N. 0
Frank, Maj. S. H. 0
Franke, Maj. G. H. 2
Franklin, Capt. E. A. 1
Franklin, Maj. E. L. 2
Fraser, Lt. F. G. 0
Frasier, Capt. L. H. 0
French, Capt. P. H. 0
Frierson, Lt. A. A. 1
Fry, Capt. H. G. 1
Fuller, Maj. H. H. 1
Fuller, Lt. J. G. 0
Fuller, Lt. W. A. 0
Fulton, Lt. A. L. 0
Gaffey, Capt. H. J. 0
Galloway, Lt. D. H. 1
Gammon, Capt. J. P. 2
Ganahl, Lt. J. 0
Gannon, Lt. M. V. 0
Gantt, Capt. H. P. 0
Garcia, Lt. H. F. 0
Gardner, Maj. A. G. 0
Gardner, Lt. F. S. 0
Gardner, Lt. R. A. 1
Garrecht, Lt. F. A., Jr. 2
Garver, Lt. R. T. 0
Gatchell, Capt. W. C. 1
Gates, Maj. O. I. 1
Gaugler, Maj. R. 0
Gay, Maj. G. S. 1
Gay, Capt. H. R. 0
Gee, Capt. C. F. 1
George, Lt. A. 3
George, Capt. H. H. 1
Gerfen, Capt. R. P. 0
Gerhardt, Capt. C. H. 6
Gerhardt, Lt. W. R. 1
Gervais, Lt. R. L. 0
Gibbons, Capt. J. R. L. 1
Gibbs, Lt. G. W. 0
Gibbs, Capt. R. C. 3
Gibney, Capt. L. G. 1
Gibson, Lt. J. K. 0
Gilford, Lt. L. W. 0
Gipson, Sgt. J. A. 2
Gjelsteen, Lt. E. 1
Glass, Maj. E. L. N. 1
Goetz, Lt. R. W. 0
Goldman, Capt. A. M. 0
Goldsmith, Lt. R. W. 0
Gomez, Lt. V. Z. 0
Goodell, Lt. F. 0
Goodwin, Lt. A. C. 0
Goodwin, Capt. S. R. 0
Goodyear, Capt. G. A. 1
Gordan, Capt. R. A. 1
Gould, Lt. H. W. 1
Graham, Lt. L. S. 1
Grant, Lt. M. F. 1
Greear, Lt. W. H. 1
Green, Capt. W. C. 1
Greene, Lt. J. N. 0
Greene, Capt. M. H. 0
Greenhalgh, Lt. P. R. 0
Greenwald, Maj. K. C. 4
Greiner, Lt. E. C. 0
Grener, Lt. L. M. 0
Griffin, Lt. Carroll R 0
Griffing, Lt. L. S. 0
Griffith, Lt. J. H. 1
Griswold, Maj. O. W. 1
Grizzard, Lt. H. N. 0
Groninger, Maj. H. M. 1
Gross, Lt. C. R. 1
Gross, Lt. J. 2
Gross, Lt. M. E. 0
Grove, Lt. W. R. 0
Grubbs, Lt. H. Y. 1
Grubbs, Lt. W. E. 0
Guenther, Capt. G. B. 1
Guernsey, Lt. H. J. 2
Gunby, Lt. T. S. 1
Gunn, Lt. D. N. 0
Gurney, Maj. S. C. 1
Haddock, Capt. G. B. 0
Hains, Lt. P. C. 0
Halff, Lt. M. H. 0
Hall, Capt. C. R. 0
Hall, Maj. H. W. 1
Halloran, Capt. M. 0
Hamby, Capt. W. R. 1
Hames, Lt. S. T. 0
Hamilton, Lt. F. L. 1
Hamilton, Capt. J. M. 0

Hamilton, Lt. W. L. 0
Hamlett, Lt. B. 0
Hammond, Capt. A. K. 1
Haney, Lt. L. W. 0
Hanna, Capt. L. M. 0
Hardin, Lt. J. L. 1
Harding, Lt. H. 0
Harding, Lt. J. G. 0
Hardy, Maj. E. N. 2
Hardy, Lt. W. H. 0
Harkins, Lt. P. D. 2
Harmon, Capt. E. N. 1
Harris, Lt. A. E. 0
Harris, Maj. A. R. 1
Harris, Lt.-Col. E. R. 0
Harris, Lt. L. 1
Harris, Capt. T. H. 2
Harrison, Lt. E. L. 1
Harrison, Capt. W. K., Jr. 0
Harrold, Lt. C. J. 0
Harrold, Lt. T. L. 0
Harshberger, Capt. E. M. 0
Hart, Lt. Chas. E. 0
Hart, Capt. E. F. 1
Hartman, Capt. J. L. 0
Haskell, Lt. J. F. 3
Haskell, Lt. L. W. 0
Hastey, Capt. T. W. 2
Hawley, Capt. D. C. 0
Hayden, Lt. G. 0
Hayden, Lt. J. C. 0
Hayden, Capt. P. S. 1
Haynes, Lt. P. O. 0
Hays, Capt. Geo. P. 1
Hazelrigg, Capt. W. R. 1
Hazeltine, Maj. C. B. 0
Heacock, Lt. W. O. 0
Healy, Lt. D. F., Jr. 0
Healy, Capt. J. H. 2
Heard, Maj. F. 1
Heard, Maj. J. W. 0
Hedekin, Lt. D. 0
Heiberg, Lt. H. H. D. 0
Henning, Lt. F. A. 2
Henry, Lt. C. E 0
Henry, Maj. W. R. 0
Hensey, Lt. W. R. 1
Herbert, Lt.-Col. W. D. 0
Herendeen, Lt. E. 1
Heriot, Lt. J. M. 0
Herman, Maj. H. 1
Herron, Capt. Thos. 2
Herr, Maj. Frederick 1
Herr, Lt.-Col. J. K. 3
Hershberger, Capt. F. C. 0
Hershey, Capt. L. B. 0
Hester, Lt. H. B. 1
Hettinger, Capt. J. A. 1
Hickman, Lt. G. W. 1
Hicks, Maj. E. H 1
Hierholzer, Lt. F. 0
Higgins, Lt. A. E. 2
Higley, Maj. H. D. 3
Hill, Capt. J. B. 0
Hill, Lt. James 0
Hill, Lt. W. H. 1
Hilliard, Lt. L. L. 0
Hilton, Capt. S. C. 0
Hinds, Lt. J. H. 0
Hine, Lt. H. C. 1
Hines, Lt. J. L. 1
Hinrichs, Lt. J. H. 0
Hinton, Lt. John 0
Hodes, Lt. H. I. 1
Hoffman, Lt. H. E. T. 0
Hogan, Lt. E. L. 1
Holbrook, Lt. W. A. Jr. 2
Holderness, Maj. A. W. 2
Holland, Lt. J. P. 0
Holle, Lt. C. G. 0
Holley, Lt. J. E. 0
Hollis, Lt. R. P. 0
Hollman, Lt. J. L. 0
Holman, Maj. O. I. 1
Holt, Capt. H. G. 1
Holt, Capt. R. T. 1
Holweger, Lt. C. P. 0
Holzworth, Lt. B. A. 0
Honeycutt, Lt.-Col. F. W. 1
Hood, Capt. J. D. 2
Hood, Lt. R. B. 0
Hopkins, Lt. E. O. 0
Horger, Capt. C. A. 2
Horner, Lt. A. A. 0
Horton, Lt. J. B 3
Horton, Lt. T. R. 0
Houghton, Capt. C. F. 0
Houghton, Capt. W. 2
Houston, Capt. L. V. 0
Howard, Capt. A. H. 0
Howard, Lt. J. G. 0
Howarth, Lt. W. L. 0
Howell, Maj. R. M. 1
Howze, Lt. H. H. 0
Howze, Lt. R. L., Jr. 1
Hoyle, Lt.-Col. R. E. de R. 3

Hubard, Lt. R. B. 0
Hudgins, Capt. P. H. 1
Hudnett, Maj. Dean. 0
Hudson, Lt. G. B. 1
Huff, Lt. R. P. 0
Huggins, Lt. Wm. C. 0
Hughes, Lt. C. E. 1
Hunter, Capt. R. G. 2
Hunter, Lt. W. H. 0
Hurt, Capt. C. M. 1
Hurt, Lt. S. R. 1
Hutcheson, Lt. C. R. 0
Hutchings, Lt. E. A. 0
Hutchings, Lt. R. B. 1
Hutchinson, Lt. C. B. 1
Huthsteiner, Capt. G. E. 5
Hutton, Lt. C. J. 0
Hyatt, Maj. R. F. 1
Ireland, Lt. R. E. 2
Irving, Lt. F. G. 0
Irving, Capt. J. H. 1
Isaacson, Lt. H. S. 0
Isker, Capt. R. A. 0
Jacobs, Lt. B. R. 4
Jacobs, Capt. F. S. 1
Jacoby, Lt. L. E. 2
Jadwin, Lt. C. C. 3
James, Lt. B. M. 0
Jay, Capt. H. D. 1
Jedlicka, Lt. F. C. 0
Jenkins, Maj. J. M., Jr. 2
Jernigan, Lt. H. S. 2
Jeter, Lt. J. R. 0
Jett, Lt. R. S. 2
John, Lt. H. J. 0
Johns, Capt. D. F. 1
Johns, Lt. W. E. 0
Johnson, Lt. A. W. 1
Johnson, Lt. E. G. 0
Johnson, Lt. H. W. 3
Johnson, Maj. J. B. 0
Johnson, Lt. K. L. 0
Johnson, Lt. M. C. 0
Johnson, Capt. N. C. 1
Johnson, Lt. O. V. 0
Johnson, Capt. R. A. 1
Johnson, Maj. T. J. 2
Johnson, Capt. W. O. 0
Johnston, Lt. E. C. 0
Johnston, Lt.-Col. Gordon 2
Johnston, Capt. J. C. 1
Jones, Lt. E. D. 1
Jones, Maj. H. L. C. 0
Jones, Capt. K. K. 0
Jones, Maj. L. E. 0
Jones, Lt. M. D., Jr. 0
Jones, Capt. Marcus E. 1
Jones, Lt. M. McD. 5
Jones, Lt.-Col. P. L. 1
Judge, Lt. L. L. 1
Justice, Lt. B. W. 1
Justus, Lt. V. W. 0
Kane, Lt. O. K. 0
Kastner, Lt. A. E. 2
Keatinge, Capt. J. H. 1
Keefe, Lt. T. F. 2
Keerans, Lt. Chas. L. 0
Kehm, Lt. H. D. 0
Keller, Lt. Col. F. 1
Kelly, Maj. J. D. 1
Kelly, Lt. J. E. 1
Kenahan, Capt. W. 1
Kendall, Lt. P. G. 0
Kennard, Maj. J. 1
Kennedy, Lt. J. P. 0
Kennedy, Maj. J. T. 2
Kernan, Capt. Harold 2
Kerr, Lt. E. V. 0
Ketchum, Lt. H. W. 0
Key, Capt. J. D. 1
Keyes, Lt. Allen L. 0
Keyes, Lt.-Col. E. A. 0
Keyes, Maj. G. 1
Kiefer, Lt. H. W. 4
Kielsmeier, Capt. S. G. 1
Kilburn, Capt. C. S. 2
Kimball, Col. R. H. 2
King, Capt. C. B. 2
King, Capt. G. A. 1
King, Capt. R. J. 0
Kinnison, Lt. H. L., Jr 1
Kirkendall, Lt. J. P. 0
Kirkpatrick, Lt. F. S. 0
Kitson, Lt. A. P. 0
Kitts, Lt. I. L. 1
Klepinger, Lt. W. J. 0
Kloepfer, Capt. H. E. 1
Kluss, Lt. Walter L. 1
Knadler, Capt. V. L. 0
Knapp, Lt. R. H. 1
Knight, Lt. Harry 0
Knudsen, Lt. C. 1
Koester, Capt. F. J. 2
Koszewski, Lt. S. S. 0
Kotzebue, Lt. L. I. 1
Kruger, Lt. H. W. 0
Kuter, Lt. L. S. 0
Kutz, Lt. C. R. 0

Kyster, Lt. O. J. 0
Lacey, Maj. A. T. 1
Lackey, Maj. J. O. 0
Ladue, Lt. L. K. 3
Lake, Lt. J. L. 0
Lambert, Capt. J. I. 0
Langevin, Lt. J. L. 0
Langhorne, Col. G. T. 1
Land, Lt. C. 1
Land, Lt. R. L. 0
Larson, Capt. Ross 1
Larter, Lt. H. C. 0
Latimer, Capt. C. W. 0
Lattimore, Capt. W. C. 2
Lawes, Maj. H. J. 1
Lawes, Lt. R. C. 0
Lawhon, Capt. Z. E. 1
Lawrence, Capt. J. O. 1
Lawrence, Capt. Renn 2
Lawton, Capt. K. B. 2
LeGette, Lt. J. Y. 1
Lentz, Lt. J. M. 1
Leone, Lt. L. P. 0
Lewis, Capt. C. D. 1
Lewis, Maj. J. E. 1
Lewis, Lt. J. H., Jr. 1
Lewis, Lt. J. L. 0
Lewis, Lt. T. E. 1
Lightfoot, Lt. F. A. 0
Ligon, Capt. Thomas 1
Lillard, Lt. G. F. 0
Lindsey, Lt. J. B. 0
Lindsey, Col. J. R. 1
Lininger, Lt.-Col. C. 1
Link, Lt. E. M. 0
Lipman, Lt. S. M. 2
Lockett, Lt. L. J. 0
Lodoen, Lt. G. O. N. 0
Lombard, Lt. S. C. 1
Longfellow, Lt. N. 0
Lord, Lt. J. B. 0
Lord, Lt. R. B. 0
Loutzenheiser, Lt. J. L. 0
Lowe, Lt. R. G. 0
Lowry, Lt. D. M. 0
Lubberman, Lt. H. A. 1
Lucas, Maj. J. P. 1
Lucas, Lt. M. H. 0
Luckett, Lt. J. S. 0
Luebbermann, Lt. B. F. 0
Lueking, Capt. H. E. 0
Lyman, Maj. C. B. 3
Lynd, Capt. R. F. 0
MacDonald, Capt. J. C. 0
MacDonald, Capt. R. 0
MacKelvie, Capt. J. W. 1
McNabb, Capt. A. B. 1
McAuliffe, Lt. A. C. 0
McBride, Lt. D. G. 0
McBride, Maj. H. L. 2
McBroom, M. 0
McCann, Lt. J. H. 0
McCarthy, Lt. L. J. 0
McCarthy, Lt. W. D. 1
McCartney, W. O. H. A. 0
McCatty, Capt. K. 0
McCauley, Lt. J. W. 0
McChrystal, Capt. A. J. 0
McChrystal, Lt. H. J. 0
McClure, Lt. Mark 4
McClure, Capt. R. A. 2
McConeghy, Capt. J. K. 0
McConnell, Lt. G. B. 0
McCormick, Lt. J. H. 0
McCormick, Lt. R. C. 0
McCoy, Maj.-Gen. F. R. 0
McCreary, Capt. M. L. 1
McCraight, Capt. W. V. 2
McDonald, Capt. John 0
McDonald, Lt.-Col. R. B. 1
McDonald, Lt. T. J. 0
McDowell, Capt. J. V. 1
McElroy, Lt. G. R. 0
McFarland, Lt. C. N. 3
McFarlan, Lt. P. 0
McFayden, Lt. B. N. 0
McGarr, Lt. L. C. 0
McGehee, Capt. Schaumburg 0
McGinley, Lt. E. 3
McGregor, Lt. T. 0
McGuire, Lt. J. C. 0
McGuire, Maj. E. C. 0
McIntosh, Capt. A. E. 0
McKay, Capt. W. R. 0
McKee, Capt. J. L. 2
McKnight, Lt. R. D. 0
McLane, Maj. J. T. 0
McLean, Lt. D. 0
McLemore, Lt. E. H. 0
McMahon, Capt. N. J. 0
McMaster, Lt. R. K. 0
McNair, Lt. D. C. 0
McNair, Lt. W. D. 1
McNaughton, Lt. K. P. 0
Mabie, Lt. R. L. 0
Mackall, Lt.-Col. S. T. 2
Maddocks, Capt. R. T. 1
Maddox, Lt. Halley G. 1

Magruder, Lt. C. B. 1
Magruder, Maj. M. 0
Maher, Capt. G. H. 0
Makinney, Lt. F. W. 4
Mallan, Capt. D. H. 0
Mallonee, Capt. R. C. 2
Malloy, Lt. H. F. 0
Malone, Lt. A. J. K. 0
Mandell, Maj. H. C. 1
Manley, Capt. N. C. 0
Manning, Lt. B. F. 0
Mansfield, Lt. C. J. 0
Manuel, Lt. T. B. 1
Manzano, Lt. N. L 0
Maraist, Capt. R. V. 1
March, Lt. F. A. 0
Margetts, Lt.-Col. N. E. 3
Marriott, Lt. O. R. 0
Marshall, Capt. Samuel 0
Martin, Lt. C. H. 1
Martin, Lt.-Col. I. S. 1
Martin, Capt. L. LeR. 1
Martin, Capt. L. O. 0
Martin, Lt. O. W. 1
Mason, Lt. D. P. 2
Massey, Capt. O. M. 0
Mathewson, Lt. L. 0
Matlack, Lt. J. B. 0
Matte, Capt. P. J. 0
Matteson, Lt. M. H. 0
Matthews, Lt. A. G. 0
Matthews, Lt. J. J. 1
Mauger, Lt. G. R. 1
Maxwell, Capt. R. R. 1
May, Lt. E. T. 0
Meador, Capt. M. F. 2
Mechling, Lt. E. P. 0
Medin, Lt. S. M. 0
Meehan, Lt. C. G. 0
Megargee, Lt. Stanleigh 1
Melanson, Lt. A. J. 0
Menoher, Maj. P. 1
Meriwether, Lt. E. C. 0
Merrick, Lt. J. G. 0
Merrill, Lt. F. D. 1
Metcalf, Lt. F. A. 2
Mewshaw, Lt. H. C. 1
Meyer, Lt. T. E. 0
Meyer, Maj. V. 1
Michela, Lt. J. A. 0
Michelet, Lt. P. D. 2
Miller, Lt. A. M., Jr. 1
Miller, Capt. C. S. 0
Miller, Lt. P. R. M. 1
Miller, Capt. T. R. 0
Miller, Lt. W. B. 1
Milliken, Maj. J. 2
Milling, Maj. T. deW. 0
Miner, Capt. Jno. W. 0
Minniece, Lt. J. G. 0
Minuth, Capt. H. C. 0
Mitchell, Maj. H. E. 1
Mitchell, Lt. P. J. 0
Mitchell, Lt. W. L. 0
Molitor, Lt. E. S. 1
Molloy, Lt. H. T. 0
Monhollan, Lt. J. E. 0
Mood, Lt. O. C. 0
Moon, Lt. J. R. 0
Moore, Lt. A. P. 0
Moore, Lt. D. M. 0
Moore, Capt. H. K. 0
Moore, Lt. J. G. 0
Moore, Lt. J. M. 0
Moore, Capt. L. R. 1
Moores, Lt. Z. W. 2
Morris, Capt. P. H. 2
Morris, Lt.-Col. W. V. 2
Morrison, Lt. C. E. 1
Morrow, Maj. N. P. 0
Morrow, Lt. S. L. 0
Morse, Lt. F. H. 0
Morse, Lt. G. V. 0
Mudgett, Lt. G. C. 2
Muller, Lt. W. J. 0
Munnikhuysen, Maj. H. D. F. 0
Murphy, Maj. D. E. 0
Murphy, Lt. E. J. 0
Murphy, Lt. J. B. 2
Murtaugh, Lt. J. O. 1
Musser, Maj. R. C. 0
Myer, Lt.-Col. E. A. 2
Myers, Lt. S. L. 0
Neal, Lt. R. M. 0
Neary, Lt. J. S. 0
Neate, Capt N. M. 1
Neill, Lt.-Col. W. H. 1
Neilson, Capt. H. H. 0
Nelson, Lt. D. H. 1
Nelson, Capt. F. 0
Nelson, Lt. R. J. 0
Neu, Capt. J. P. 1
Neundorfer, Capt. O. J. 0
Neven, Lt. S. M. 0
Newall, Capt. O. C. 0
Newman, Lt. H. S. 0
Newman, Lt. O. P. 1
Nichols, Capt. J. A. 1

Noble, Lt. C. H. 2
Norton, Capt. A. H. 1
Oakes, Lt. J. C. 0
Oberst, Lt. F. X. 0
Ochs, Capt. W. V. D. 2
O'Connell, Lt. W. W. 1
O'Connor, Maj. J. A. 1
O'Connor, Lt. W. 1
Odle, Warrant Officer, B 2
Odell, Maj. H. R. 1
O'Donnell, Maj. L. A. 1
O'Keefe, Capt. D. 1
Oliver, Lt. R. C. 0
Opperman, Capt. L. A. 0
Oreth, Capt. I. M. 0
O'Shea, Lt. Kevin 0
Page, Maj. D. J. 1
Paine, Lt.-Col. G. H. 1
Palmer, Lt. C. D. 1
Palmer, Capt. C. H. 0
Palmer, Sgt. C. R. 2
Palmer, Lt. R. D. 0
Paquet, Lt. L. C. 0
Parker, Maj. C. 3
Parker, Maj.-Gen. Frank 0
Parker, Capt. H. B. 0
Parker, Capt. R. S. 0
Parmley, Lt. L. F. 0
Partridge, Lt. R. C. 0
Patterson, Maj. R. B. 0
Patton, Maj. G. S. 4
Peabody, Capt. O. S. 0
Pearce, Lt. C. N. 0
Pegg, Lt. L. D. 0
Pence, Lt. G. 1
Pendelton, Maj. W. A. 0
Pennell, Lt. Col. R. McT. 2
Perry, Capt. R. F. 1
Peyton, Maj. B. R. 1
Pharr, Lt. Marion M. 0
Phelps, Lt. J. V. 1
Philips, Maj. J. L. 1
Phillips, Capt. R. E 0
Pickering, Capt. C. E. 0
Pickett, Capt. C. 0
Pierce, Capt. C. A. 0
Pierce, Capt. J. A. 0
Pierce, Lt. J. R. 1
Pierce, Maj. J. T. 1
Pierce, Lt. W. F. 0
Pilkington, Capt. G. C. 1
Pinkerton, Lt. C. R. 0
Pitts, Lt. Y. A. 1
Poindexter, Capt. W. O. 1
Poole, Maj. T. 0
Ports, Lt. R. A. 0
Potter, Lt. M. M. 0
Price, Lt. G. S. 1
Price, Capt. T. E. 1
Prickett, Maj. F. B. 2
Proctor, Capt. G. 2
Prouty, Lt. S. M. 0
Prunty, Lt. C. H. 0
Purdie, Capt. K. S. 0
Pyle, Lt. C. A. 1
Quekemeyer, Lt. R. K. 0
Quesenberry, Capt. M. H. 0
Quill, Lt. J. B. 0
Raguse, Lt. C. A. W. 0
Ramey, Capt. R. 0
Ranck, Lt. J. R. 0
Rapp, Lt. L. B. 0
Rasbach, Lt. J. B. 1
Rasor, Capt. W. I. 2
Rathjen, Capt. H. F. 0
Raymond, Lt. R. R. 0
Read, Maj. B. Y. 0
Read, Lt. G. W., Jr. 3
Reardon, Lt. W. J. 1
Redman, Capt. John W. 0
Reed, Lt. A. 0
Reed, Lt. C. H. 2
Reed, Lt. H. D. 2
Reed, Lt. James 0
Rees, Lt. J. E. 1
Regnier, Capt. E. A. 0
Rehm, Lt. G. A. 0
Reid, Lt. G. J. 0
Reinberg, Capt. W. H. W. 1
Reipe, Lt. J. H. 1
Renfro, Lt. C. D. 0
Renshaw, Capt. S. B. 0
Reynolds, Lt. A. S. 2
Reynolds, Lt. Roy D. 0
Rhinehardt, Maj. C. K. 1
Rhodes, Lt. E. L. 1
Rice, Capt. E. L. 1
Rich, Lt. T. L. 0
Richardson, Capt. H. O. 0
Richmond, Maj. J. F. 1
Ridge, Lt. P. A. 1
Rieman, Capt. G. 0
Riggs, Lt. B. L. 0
Riggs, L. T. S. 0
Ritchie, Lt. W. S. 1
Robenson, Maj. J. A. 1
Roberson, Lt. W. S. 0
Roberts, Lt. F. A. 1

Robinett, Lt. P. M. 0
Robins, Jr., Lt. C. P. 0
Robins, Maj. T. M. 1
Robinson, Capt. H. W. 0
Robinson, Capt. J. S. 1
Robinson, Lt. T. 3
Rodes, Capt. P. P. 6
Rodwell, Capt. J. S. 1
Roemer, Lt. L. E. 0
Roemer, Capt. T. M. 0
Rogers, Lt. G. B. 1
Rogers, Capt. J. C. 3
Rogers, Capt. R. W. 0
Roper, Lt. H. M. 0
Rose, Capt. M. 0
Ross, Lt. J. 0
Ross, Capt. M. 1
Round, Lt. R. E. 0
Roxbury, Lt. E. J. 2
Royce, Lt. C. H. 0
Royse, Capt. F. E. 1
Ruffner, Lt. C. L. 0
Rumbough, Capt D. S. 1
Rundel. Capt. R. M. 0
Russell, Capt. A. J. 0
Russell, Capt. Randolph 0
Russell, Capt. R. W. 1
Ryan, Lt. J. L. 0
Ryan, Capt. W. O. 1
Ryder, Capt. I. E. 0
Samouce, Lt. J. A. 1
Samouce, Lt. W. A. 1
Sancomb, Lt. P. B. 0
Sanderson, Capt. J. M. 0
Sands, Maj. A. L. P. 0
Sandlin, Capt. E. O. 0
Sappington, Maj.-W. F. 0
Sargent, Lt. C. E. 2
Sasse, Maj. R. I. 2
Sawtelle, Lt. D. W. 1
Schaffer, Lt. W. H. 0
Scherer, Lt. H. F. 0
Schjerven, Lt. Einar N. 0
Schmidt, Capt. F. O. 0
Schoor, Lt. D. M. 0
Schriver, Lt. A. J. J., Jr. 0
Schucker, Capt. F. R. 0
Schuyler, Capt. R. L. 0
Schwab, Lt. J. A. 0
Schwenck, Maj. J. C. R. 1
Scott, Capt. D. M. 3
Scott, Lt. J. D. 2
Scott, Lt. W. C. 0
Searby, Lt. E. W. 0
Searight, Lt. H. F. 0
Searle, Capt. A. C. 1
Segundo, Lt. F. V. 0
Selee, Lt. R. 0
Sells, Lt. J. K. 0
Selway, Lt. R. R., Jr. 0
Sexton, Lt. Wm. T 0
Seymour, Capt. R. T. 0
Shaifer, Major E. F. 0
Shannon, Capt. C. A. 0
Sharp, Capt. F. D. 3
Shaw, Capt. C. R. 1
Shaw, Lt. V. F. 0
Shea, Lt. A. F. 2
Shea, Capt. G. D. 1
Shea, Capt. P. E. 0
Shearer, Capt. D. McD. 1
Sheehan, Lt. T. F. 0
Sheets, Capt. A. M. 0
Sheldon, Lt. C. H. 0
Shelton, Capt. J. M. 0
Shelton, Maj. J. R. 0
Shepard, Lt. L. 0
Sherburne, Col. T. L. 0
Sherburne, Jr., Lt. T. L. 0
Sherwood, Capt. P. H. 2
Short, Capt. J. C. 4
Shubert, Warrant Officer 0
Shumate, Lt. P. W. 0
Simmonds, Lt. C. D. 0
Simpson, Lt. J. R. 1
Simpson, Maj. W. H. 1
Sims, Lt. T. A. 0
Sinclair, Lt. F. H. 0
Skelton, Lt. W. G. 0
Skerry, Capt. L. M. 0
Slack, Lt. J. E. 1
Slider, Lt. R. H. 0
Slocum, Capt. L. H. 1
Smith, Capt. A. C. 1
Smith, Lt. C. A. 2
Smith, Maj. C. C. 6
Smith, Capt. G. I. 2
Smith, Lt. G. S. 1
Smith, Maj. H. J. M. 2
Smith, Lt. J. 0
Smith, Capt. John A. 4
Smith, Lt. L. G. 3
Smock, Capt. S. C. 0
Snyder, Lt. C. E. 1
Snyder, Lt. J. A. 1
Solem, Lt. A. E. 0
Sothern, Capt. R. J. 0
Soule, Lt. R. H. 0

Sperry, Capt J. R. 0
Spettel, Lt. F. J. 1
St. John, Capt. A. 1
Stadler, Lt. J. H. 2
Stafford, Capt. C. L. 3
Stancisco, Lt. S. E. 0
Stearley, Lt. R. F. 2
Steele, Lt. C. E. 0
Steiger, Capt. W. C. 0
Stephenson, Lt. W. G. 1
Sterling, Lt. J. M. 0
Stevenson, Lt. H. W. 0
Stevenson, W. G. 0
Stewart, Lt. L. J. 0
Stewart, Capt. S. G. 1
Stillinger, Lt. O. H. 0
Stober, Lt. M. F. 0
Stockton, Lt. M. L. 2
Stodter, Lt. J. H. 0
Stratton, Lt. C. W. 0
Stratton, Lt. J. H 0
Strawn, Capt. C. C. 0
Strickland, Lt. F. H. 1
Strickler, Lt. D. G. 0
Strohbehn, Lt. E. L. 0
Strong, Lt. P. N. 1
Strong, Maj. R. W. 0
Stubblebine, Lt. A. N. 0
Sturdevant, Maj. C. L. 1
Sturman, Lt. J. F. 0
Sugg, Lt. O. D. 0
Sugrue, Lt. C. D. 0
Sumner, Capt. E. M. 0
Sundt, Lt. D. N. 0
Surles, Maj. A. D. 2
Sutherland, Lt. O. R. 0
Sutton, Lt. H. T. 1
Svensson, Lt. E. 0
Sweet, Capt. J. B. 0
Swift, Lt.-Col. Eben, Jr. 1
Swift, Lt.-Col. I. P. 3
Swift, Lt. Ira P. 0
Swing, Maj. J. M. 3
Syme, Lt. L. D. 0
Talbot, Maj. R., Jr. 1
Tallent, Capt. R. E. 0
Tansey, Lt. T. H. 1
Tate, Lt. F. J. 1
Tate, Capt. J. S. 4
Taulbee, Maj. E. W. 1
Taulbee, Col. J. F. 2
Tausch, Lt. C. R. 0
Tayler, Lt. R. L. 1
Taylor, Capt. J. B. 1
Taylor, Maj. T. F. 1
Taylor, Maj. V. V. 2
Thayer, Capt. A. P. 2
Thayer, Lt. B. G. 2
Theis, Lt. H. J. 0
Thomas, Lt.-Col. R. S. 0
Thompson, Lt. Frank J. 0
Thompson, Capt. G. D. 1
Thompson, Maj. J. B. 2
Thompson, Lt. P. S. 0
Thomson, Lt. E. F 2
Thornburgh, Lt. T. T. 1
Thornton, Lt. H. I. 0
Thorp, Lt. C. A. 0
Thorpe, Lt. G. C. 0
Thorpe, Lt. W. 0
Thummell, Maj. C. B. 0
Tilson, Maj. J. C. F., Jr. 0
Timmins, Lt. J. W., Jr. 1
Todd, Lt. W. N. 0
Tombough, Lt. P. E. 1
Tompkins, Lt.-Col. D. D. 1
Tompkins, Capt. W. F. 1
Toole, Capt. Leslie E. 0
Torbet, Lt. O. C. 1
Trapolino, Lt. T. F. 0
Trapnell, Lt. T. J. 1
Tent, Lt. J. F. 0
Trew, Lt. F. G. 0
Trudeau, Lt. A. G. 0
Truscott, Capt. L. K. 4
Truxes, Capt. A. H. 2
Tully, Maj. J. M. 1
Tuttle, Capt. W. B. 0
Turnbull, Maj. S. J. 1
Turner, Lt. F. T. 0
Tyler, Lt.-Col. M. C. 0
Tyndall, Lt. B. A. 0
Unger, Capt. C. H. 1
Upton, Capt. P. R. 1
Valentine, Lt. C. H. 0
Vance, Lt. Lee C. 0
Van Houten, Lt. J. G. 1
Van Natta, Lt. T. F. 0
Vanture, Lt. G. D. 0
Van Wyck, Lt. H. 2
Van Tuyl, Lt. H. E. 0
Vapsala, Lt. A. E. 0
Vincent, Lt. J. W. 0
Vocke, Lt. L. 1
Voight, Capt. T. E. 4
Von Ressler, Maj. W. C. 0
Wahl, Capt. G. D. 1
Wakefield, Lt. M. F. 1

Waldron, Capt. N. E. 1
Wales, Maj. V. W. B. 0
Walker, Lt. H. E. 0
Walker, Capt. I. G. 1
Walker, Lt. J. H. 1
Walker, Lt. S. P. 0
Walker, Lt. W. A. 0
Wall, Maj. J. F. 1
Walsh, Maj. R. L. 1
Ward, Lt. J. T. 2
Ward, Lt. R. W. 0
Washburn, Capt. J. H. 1
Waters, Lt. W. C. 0
Watkins, Capt. H. E. 0
Watkins, Capt. J. G. 0
Watson, Capt. H. L. 1
Watson, Maj. J. A. 1
Watters, Lt. W. E. 0
Weaver, Maj. W. G. 1
Wedemeyer, Lt. W. A. 0
Weeks, Maj. H. J. 2
Weeks, Capt. J. W. 0
Welch, Capt. G. B. 0
Wells, Lt. J. B. 0
Wells, Lt. L. F. 0
Wenzlaff, Lt. T. C. 0
Wesner, Lt. C. 0
West, Lt. G. W. 0
Westlund, Lt. C. W. 1
Westphalinger, Lt. H. R. 1
Wharton, Lt. S. F. 0
Wheeler, Pvt. J. 1
Whelan, Lt. J. A., Jr. 0
Whelan, Lt. P. C. 0
Whelchel, Lt. W. W. 0
Whisner, Capt. E. B. 2
White, Lt. A. F. 0
White, Lt. H. V. 0
White, Lt. I. D. 3
Whitehead, Lt. F. E. 0
Whitehouse, Lt. B. M. 0
Whitmore, Lt. C. S. 1
Whittaker, Capt. F. L. 1
Whitted, Lt. T. B. 0
Wickham, Capt. F. O. 0
Wiener, Capt. Wm. M. 0
Wilder, Capt. C. J. 2
Wilkinson, Capt. C. A. 6
Williams, Capt. A. W. 0
Williams, Maj. C. F. 1
Williams, Capt. E. A. 1
Williams, Lt. E. T. 2
Williams, Col. G. 0
Williams, Lt. I. J. 0
Williams, Lt. J. F. 2
Williams, Lt. J. H. 0
Williams, Capt. J. R. 1
Williams, Lt. L. O. 0
Williams, Lt. P. L. 0
Williams, Capt. S. T. 1
Williamson, Lt. G. McK. 0
Williamson, Capt. M. S. 0
Williamson, Lt. R. E. S. 0
Willis, Lt. A. N. 0
Willis, Lt. J. B. 0
Willis, Capt. R. B. 1
Willson, Lt. Richard T. 0
Wilson, Maj. A. H. 4
Wilson, Capt. A. R. 1
Wilson, Capt. Chas. H. 1
Wilson, Lt. G. H. 0
Wilson, Lt. O. O. 1
Winans, Maj.-Gen. E. B. 0
Winfree, Lt.-Col. S. W. 1
Wing, Capt. A. G. 1
Wing, Lt. F. F., Jr. 1
Wingfield, Lt. L. R. 1
Winn, Lt. J. S., Jr. 1
Winn, Lt. N. M. 0
Wipprecht, Capt. R. 1
Wise, Capt. K. B. 1
Wisetogel, Lt. C. O. 0
Withers, Lt. W. P. 0
Wofford, Lt. J. W. 3
Wogan, Maj. J. B. 1
Wolfe, Capt. W. R. 1
Wood, Capt. D. S. 3
Wood, Lt. W. H. 0
Woodbury, Lt. M. C. 0
Woodruff, Capt. R. C. 1
Woodward, Maj. W. R. 1
Works, Lt. J. M. 1
Wren, Lt. W. B. 0
Wright, Lt. W. H. S. 0
Wychie, Maj. I. T. 0
Wyman, Lt. W. G. 0
Yale, Lt. Wesley W. 0
Yancey, Lt. W. J. T. 0
Yeager, Maj. E. 0
Yeaton, Lt. I. D. 1
Yeats, Lt. J. J. 2
Yeo, Lt. S. 0
Yeomans, Lt. P. E 0
Young, Lt. E. W. 0
Young, Capt. M. L. 1
Younger, Capt. J. W. 1
Zeller, Lt. H. M. 0

R. O. T. C. AT THE UNIVERSITY OF OKLAHOMA

A STUDENT'S VIEWPOINT

By CARL ALBERT

EDITOR'S NOTE: Carl B. Albert is a senior in the University of Oklahoma, recently elected as Rhodes scholar from the southern district of the United States, Phi Beta Kappa, Cadet Colonel in the R.O.T.C. and President of the Student Council.

THE students of the University of Oklahoma are justly proud of their R. O. T. C. unit. Its standing among others of the Eighth Corps Area and of the country, the progress it has made during the last four years, and the splendid opportunities it offers for needed training in different fields deserve the commendation of every citizen of this state.

My personal contact with the Department of Military Science here has revealed to me that, at least as far as this particular unit is concerned, the R. O. T. C. is endeavoring to teach university men the fundamentals of cooperation, of fellowship, and of leadership. It is therefore training a group of civilians, not only to be able to defend the colors in time of crisis, but also to be leaders in their communities in times of peace.

We use here the same general plan found among all units. Work is divided between class room instruction and drill. The entire course consists of basic and advanced training. A review of this plan in action will reveal the importance of its place in the program of the university.

First of all, it serves as a sort of balance wheel for freshmen. When the average boy matriculates in college he goes out of the reach of the eyes of his parents for the first time. A new environment is placed before him. New temptations are shoved in his face. His father is not there to make him study his lessons or attend his classes. With his desire to accommodate his attitudes to those of the new situation, with his ambition to prolong the thrills of rush week, with his attempts to make himself immediately a "typical college lad" he faces the danger of losing sight of the things that are most essential to the progress of the individual.

Military training helps to supply this deficiency. Two hours of close order drill every week has a disciplinary value that is not found in any other activity. This fact of discipline alone justifies the existence of compulsory military training for freshmen and sophomores.

Another worthwhile feature of close order drill as conducted here is that it offers many good lessons in leadership. Sophomores perform the duties of non-commissioned officers and the upper classmen organize, instruct, and drill groups of men ranging from the battery to the brigade.

During one semester of the sophomore and junior years the cadets are trained in the principles of horsemanship and mounted drill. Throughout the entire course, in fact, the class work as taught here has a great deal of cultural and practical value. Hygiene, first aid, gunnery, organization, are taught freshmen. One semester of the sophomore year is spent in the study of the care and use of horses. It is interesting to note that even in this cowboy state of Oklahoma, a large per cent of the college students ride their first horse when they enroll in Military Science III. In addition to equitation and mounted drill the sophomores study the elements of command and leadership, topography and map reading, telephone communications, and the use of artillery fire control instruments.

In the last two years of the R. O. T. C. course the cadet officers receive double credit for their work and a sum of about $100 per year. The juniors are trained in advanced horsemanship, Field Artillery gunnery and conduct of fire, pistol marksmanship, fortifications, communications, camouflage and administration.

In the senior year, the class work consists of the study of tactics, military history and military law. Of course the necessity of these courses is essential to all officers of the United States Army. But military history especially, in my opinion, is one of the most broadening and cultural courses that are taught in the university. A knowledge of the tragic errors that have been made because of untrained officers seems to me to be a prerequisite to intelligent citizenship.

In the summer, following the junior year, the Advance Course students spend six weeks in camp at Fort Sill. There they are organized in batteries and trained in all the elements of Field Artillery work. They act both in the capacity of cannoneers and of battery commanders observing and conducting actual fire on the range.

It was the pleasure and good fortune of my class to attend camp last summer. I have heard it said by any number of those who were there that the six weeks at Sill constituted one of the most enjoyable vacations that they have ever had.

There we not only received the training and the exercise which go along with military duties, but received from our officers many favors that will be long appreciated and remembered. We were served food far above the class of any I have ever found at any other camp. We had weekly social functions and were privileged one evening with a dance at the Officers' Club. In addition to this we spent the afternoons swimming or competing in different sports with the rival Infantry unit made up of cadets from Oklahoma Military Academy and Oklahoma A. and M. During the evenings and week-ends we were free to go to Lawton or to Medicine Park, a nearby summer resort. With the regularity and discipline of the camp, with plenty of intensive work and exercise, with ample recreation and entertainment, the six weeks passed hurriedly by and left in our minds the memory of an exceedingly well spent vacation.

At school, as well as in camp, may be found many encouraging activities connected with the Department of Military Science. These activities not only help raise the interest of students in the Department, but also help to advertise the school and to supply considerable opportunities for participation in sports not offered by the regular athletic department.

Our polo team, for example, was brought here by reason of the establishment of this unit. It is trained by one of our army officers and has developed into one of the finest in the southwest. Our pistol team won the National Championship last year. We also have competitive drills, offering prizes to winning batteries. Then at the end of each school year splendid

awards are given to outstanding students of the department. In addition to this, we are fortunate in having riding clubs and an annual horse show in which competition is always keen.

It would be difficult to estimate the value of these activities to the student, the unit, and the school. Suffice to say that they have a tremendous effect upon the morale of the students. They certainly have furnished no small part of the incentive which has caused the cadets to work hard and consistently and to obtain thereby the rank that the unit now holds.

Four years ago the R. O. T. C. here was made distinctly a Field Artillery Unit. Prior to that time, it was both Infantry and Artillery. During that same year also Major Parker, the present head of the Department, came here. Having been one of the class that entered the university that year, it has been my fortune to see his work from the day he came until the present time. Even a casual observer could not fail to note that tremendous improvements have been made.

Not the least among the changes is that of the increased percentage of basic men that are taking the advance work. In 1927 there were 1,180 students in the first course and 143 in the advance. Today the score stands 1,325 and 282. Along with this many material improvements have been made throughout the Department. Around the Armory one unconsciously obtains a sense of completeness and order. This is much more a fact today than it was four years ago. The saddle room and other buildings in the stable area are supplied with gas heat instead of coal. An additional battery of 75 mm. guns has been added making four complete batteries of French 75's here. Two new polo fields have been built. Over three thousand dollars have been spent for one hundred beautiful band uniforms. The band has also been furnished with new lockers. These and other facts give one an idea of the material progress which the Department has made.

Besides our military instruction, we have two annual military balls and a sponsor's day program. We are generally called upon to furnish the outstanding features of parades and other

activities. As a result this unit has become an integral and outstanding part of the school.

What has been the cause of this development? There can be but one answer: Namely, the type of instructors the department has been fortunate enough to obtain plus the keen executive ability of Major Parker. Major Parker and his staff of assistants have come to the university and have stood square shouldered behind every movement that the university has made. They have taken an active interest in civic enterprises and have proved themselves community builders. I mention these points only to bring out the attitude that our townspeople have toward the Department and its staff.

This same spirit of interest and cooperation is exhibited by other faculty members and many of the leading students of the school. In the advance course, which is optional, may be found the captain and the outstanding football players of the school, three out of four of the men of the junior class who were Phi Betta Kappas, the president of the Student Council, the president of the Engineers' Club, and in general, all of the men who are the most promising in their various field of endeavor. This fact, alone, seems to indicate the respect that is shown for Major Parker's work. Although he will leave here to occupy a better position next year his departure will be regretted by thousands of students and citizens; his work will be remembered in Oklahoma as long as this state appreciates the conscientious efforts of an able man. He has given a splendid unit to us and we all, I believe, feel justly proud of it.

UNIVERSITY OF OKLAHOMA AT NORMAN SHOWING R.O.T.C. BUILDINGS AS FOLLOWS: 1—ARMORY, 2—STABLES, 3—BLACKSMITH SHOP, 4—SADDLE ROOM, 5—GUN SHED, 6—RIDING HALL, 7—DRILL FIELD.

SELF-PROPELLED 75MM. GUN M1916 ON MARK VII MOUNT, WHICH WAS TESTED AS AN ACCOMPANYING GUN BY THE 83RD F. A. AT THE INFANTRY SCHOOL

A TEST OF AN ACCOMPANYING GUN

BY IVAN L. FOSTER, CAPT. 83d F.A.

ON NOVEMBER 20, 1929, a Self-Propelled 75 mm. Gun (Mark VII) was delivered to the 83rd Field Artillery at Fort Benning, Georgia, for test as an Accompanying Gun under the supervision of the Infantry Board. The test was planned solely for the purpose of determining the suitability of S.P. weapons for such use and not to determine the fitness of the (Mark VII) Mount which was already classed as approaching obsolescence.

This gun and mount had been under test at various times since its construction in 1919 by the Holt Manufacturing Company. Various modifications had been made so that the machine which was received by the 83rd Field Artillery conformed to the following specifications:

Mount—2½-ton tractor type.
Gun—American 75 mm., Model 1916, with wheels removed, axles cut off and suspended in special brackets or trunnions on the mount.
Armor—Over engine and radiator only and partially cut away to prevent overheating.
Motor—Cadillac 8 cylinder, V-type, with Delco ignition and auto-pulse gasoline feed, developing 32 H.P. at 1500 R.P.M. and 70 H.P. at 2600 R.P.M.
Gasoline carried—20 gallons.
Oil carried—2 gallons.
Purolator oil filter and cooler.
Radiator capacity—7 gallons.
Length of machine—136 inches.
Width of machine—63 inches.
Height of machine—71 inches.
Road clearance—12 inches.
Water clearance—34 inches.
Unit ground pressure—8 lbs. at 3-inch submergence.
Weight without crew or ammunition—10,600 lbs.
Speed—2 to 15 miles per hour.
Cruising range—about 30 miles.
Seating capacity for crew of 4.
Traverse of gun at 0 degrees elevation—600 mils.
Traverse of gun at 40 degrees elevation—400 mils.
Ranges—0 to 9,000 yards.

The mount was first tried out in the gun park by a crew of three carefully selected men supervised by the writer who had been placed in direct charge of the test. The results were quite disappointing due to bad condition of the power-plant and faulty construction in general. The following deficiencies were noted at this time: insufficient power and speed, difficult to get

onto and off of firing wedges, no self-starter, traversing and elevating gears too slow and too limited, no ammunition chests and no shield for the personnel.

The machine was turned over to the local Ordnance Shop for an overhaul which revealed a need for many new track-shoes, links, pins, etc., which were not on hand and had to be ordered. The 3,000 miles (more or less) which the machine is supposed to have run during the first ten years of its life had left their mark upon it. The attentions of the Ordnance Officer filled the engine with new vim and vigor. Some trouble developed later in the auto-pulse system but was corrected by the Ordnance experts. Thereafter most of the correctible troubles arose from breakage of parts of the track assembly.

While the Ordnance personnel were engaged in putting the machine in good condition as above outlined, the Test Officer acting under instructions from the Infantry Board prepared an outline of a test programme for the gun. It was planned to run all tests concurrently with the Infantry School demonstrations and the training problems of the 29th Infantry and the Tanks (2nd Battalion, 1st Tank Regiment). The following was therefore laid down as a general programme of test:

1. Training of crew in maneuvering and firing before taking part in any demonstrations or problems.
2. Miscellaneous training problems with the 29th Infantry and the Tanks.
3. Use as an accompanying gun during the school demonstration of an Infantry battalion in defense.
4. Use as an accompanying gun during the school demonstration of an accompanying battery with an advance guard.
5. Use as an accompanying gun during the school demonstration of an Infantry battalion in attack.

More specifically, it was planned to make the test consist of problems in maneuverability and visibility on the march and in simulated action while in support of Infantry and Tanks. This to be followed by testing the quickness, accuracy and power of the gun by firing upon stationary, bobbing and moving targets during problems and demonstrations.

The purpose of the test was to determine the suitability or non-suitability of a self-propelled weapon as an accompanying gun.

Complete information was to be sought as a basis for recommendations or suggestions which might lead to the production of an effective up-to-date accompanying gun. The board decided to use a horse-drawn section of a "French" 75 mm. Gun Battery as a standard of comparison.

The following supplies were requested for use during the test:

37 mm. sub-calibre tube	1
Gasoline	300 gallons
Lubricating Oil	12 gallons
Transmission Oil	5½ gallons
Kerosene (for cleaning)	10 gallons
Hard Grease	115 lbs.
37 mm. Low Explosive Shell	200 rounds
75 mm. Shrapnel	200 rounds

Of the above, all except the ammunition was provided as requested. Only 100 rounds of 37 mm. ammunition were made available and only 40 rounds of shrapnel had been fired when the test was discontinued. The use of 37 mm. ammunition was responsible for a big saving in 75 mm. ammunition of which only 7 rounds were fired for training purposes prior to actual demonstration work.

When the mount and gun were returned from the Ordnance Shop, drills in the gun park were resumed, and it was decided that a crew of one officer, one gunner-corporal and two privates (Cannoneers No. 1 and No. 2) would constitute the test crew. All members of the crew were required to have a thorough general knowledge of the gun and mount and their control and operation. Duties were divided as follows:

Officer—To locate positions and routes.
To indicate time and speed of occupation of position or departure therefrom.
To act as gun-marker.
To control the fire.

Gunner-Corporal—To cause the gun to go into position exactly as indicated by the officer.
To assist in preparing for action or marching.
To lay and fire with the utmost speed.

Cannoneer No. 1—To drive the mount.
To perform all duties of a Cannoneer No. 1.

Cannoneer No. 2—To perform all duties of No. 2.
To act as assistant driver.

Speed both in occupying and in leaving a position being most essential to the continued life of an accompanying gun and its

crew, considerable attention was paid to training the crew in making a concerted effort in the execution of prepare for action and march order. Everyone was impressed thoroughly with the fact that he must be both a motor-man and a cannoneer. Accuracy and speed were the watchwords, not only while simulating fire or actually firing, but during every part of the drill.

On February 14, 1930, the gun was tested behind a horse-drawn battery which made a 14-mile march over varied terrain some of which was quite difficult. On the first half of the march, the S.P. gun followed the battery without much difficulty while running at speeds varying from 3½ to 8 miles per hour. It was noted, however, that the machine was under-powered, that the tracks of the machine were too short and that the projecting front was apt to catch against a sharp wall or rise of dirt in coming up out of a ditch or gully.

On the return march via another route, all went well for about an hour. Then a deep muddy creek crossing was attempted after the horse-drawn battery had gone through and churned up the mud. It was also quite evident that the tracks were too narrow and consequently cut into the mud more than they should. In other words, the unit ground pressure was too great. It appeared almost impossible to climb the sharp bank of the creek because the shortness of the tracks tilted the machine back so far that it seemed ready to turn over. After three attempts on the part of the driver, he gave up and the machine appeared to be mired down. An officer then "took the throttle" and finally managed to drive it out.

Shortly after this, while running at top speed (12 to 15 miles per hour) on a fairly good road in an effort to catch the battery, a track shoe broke and stopped the machine for nearly an hour. When repairs had been made, the gun ran on in at high speed without further trouble. During the march, observations were made which led to the conclusion that the visibility of the S.P. gun is much less than that of a horse-drawn gun while marching.

On February 26, 1930, sub-calibre service practice was conducted for the first time and good results were obtained. Due to the fact that the sub-calibre tube was of the "inner-tube"

type, the crew secured quite realistic experience during this firing. However, it was apparent that further gun park training was needed and it was given prior to the next firing.

On March 3, 1930, sub-calibre firing was renewed combined with drills in going into and out of position and followed by 75 mm. firing. The performance of the crew was greatly improved. The time required to go into action from concealment in a ravine about 200 yards distant and open direct fire properly placed on targets at 800 to 1600 yards averaged one minute and twenty-five seconds. To get off the firing wedges, go out of action and return to the same concealment averaged one and one-half minutes. It was quite evident that the firing wedges were the cause of considerable slowness. Sometimes, due to a false movement on the part of a member of the crew, one of the wedges did not go under the track and then the machine had to be moved forward so the wedges could be reset. Getting onto them promptly before firing and off of them quickly after firing requires skill and precision. A saving of about twenty seconds each way made by not using the wedges but the 75 mm. ammunition caused the mount to rock so violently that it was thought better to use them.

The officer was obliged to seek positions such that the front end of the machine would be lower than the back in order to secure low angles of fire when the wedges were not used. On level ground, with wedges in place, no such difficulty was experienced.

Firing 37 mm. ammunition while the engine was running had no apparent effect on the motor. On the other hand, one round of 75 mm. ammunition so fired, stopped everything, including the test officer's heart action. He had read a report of a previous test which said the electrical system had been injured by firing while the motor was running. He was so relieved when he found that the motor would start and run again that he did not repeat this experiment.

During the two tests of firing already described, 100 rounds of 37 mm. low explosive and 7 rounds of 75 mm. shrapnel were used.

The general procedure during this combined drill and test was for the officer to make a reconnaissance for the exact gun position, then signal to the gun crew to come up while he stood where the front of the machine was to go and indicated the direction of the target.

Cannoneer No. 1 then drove the machine to the position and gave it the indicated direction. The Gunner and Cannoneer No. 2 loosened the wedges and at the proper time, dropped them and held them down while the mount was backed onto them and the ignition cut off. All men working together then prepared for action and opened fire with the data announced by the officer.

In going out of position, No. 2 cranked the motor while the Gunner and No. 1 returned the gun to the travelling position. No. 1 then sprang into the driver's seat and drove forward while the Gunner and No. 2 picked up the wedges and fastened them in the travelling position.

An improved wedge and an electric starter on a machine of the type under test would do much to promote speed and perhaps increase accuracy during the operations above outlined. It was also noted that the slowness of the traversing and elevating gears, and the cramped and awkward positions necessarily taken by the Gunner and No. 1 at extreme traverses were serious deficiencies which should be corrected in future designing.

On March 5, 1930, the Test Officer went to the hospital as a result of an accident and consequently did no more experimenting with the S. P. gun until the middle of June.

On March 27, 1930, under another officer, an accompanying gun test was made during the demonstration of an accompanying battery with an advance guard. While the battery was out of action during a displacement, two accompanying guns, one-self-propelled and one horse-drawn, were ordered to come forward from a concealed position some 300 yards in rear of a crest. They were ordered to place direct fire upon some enemy machine guns represented by panels about 1,200 yards distant. Each gun was to fire upon a separate panel.

Upon signal from the officer in charge of the demonstration,

both guns started forward. The horse-drawn gun opened fire in one minute and thirty-two seconds, the S. P. gun in one minute and forty seconds after some delay on account of the driver stalling his motor while backing onto the wedges. Both guns remained in action for two minutes during which the horse-drawn gun fired 10 rounds with 3 target hits and the S. P. gun fired 14 rounds with 3 target hits. Both guns then went out of action and raced for concealment which was reached first by the horse-drawn gun.

The ammunition for the horse-drawn gun was carried in a caisson to a point near the position and then carried up by hand. The S. P. gun had not means of carrying ammunition, so its supply had been placed on the ground near the expected firing position before the test began. The ammunition was then carried to the gun by two additional members of the crew. A total of 8 men including drivers were used to man the horse-drawn gun. Only 5 men including the ammunition carriers were used for the S. P. gun.

The injured test officer had planned to borrow a T. E. cross-country cargo-carrier from the Tanks and use it to carry ammunition for the S. P. gun, but this was not done.

The visibility of the S. P. gun was considerably less than that of the H. D. gun while going into action but was somewhat greater while in position.

No further test were made until June 3, 1930, when the S. P. gun was attached to a platoon of tanks during a maneuver. It performed as satisfactorily during this test of its maneuverability as could be expected. No firing was done.

On June 25, 1930, after several gun park drills had been held, the gun and crew were used by the original test officer for service practice. From a position in concealment among trees in a ravine, the gun was run forward about 150 yards upon signal and fire was directed upon a panel representing a machine gun firing from the open. After a total time of two and one half minutes, the target was theoretically out of action as a result of 8 rounds fired at ranges of 1,600 to 1,800 yards. The gun was then

returned to its position of concealment which required about two minutes. Again, the firing wedges caused a loss of time.

The next problem was fired from a slightly different position and against a taget some 1,600 mils to the right of the first one and at a range of about 1,300 yards. Eleven rounds were fired against a bush representing 37 mm. gun firing from the open. The time required to approach, go into action, and accomplish the mission was three and one-half minutes. The gun went out of action and to cover in one minute and fifteen seconds. The wedges were not used in this problem. The mount was very unsteady and caused the gunner considerable difficulty while firing. The ammunition was delivered to the gun position in a "buck-board."

Further tests were planned to commence in October, 1930, but were not made because the gun was suddenly called in for shipment to the Mechanized Force at Fort Eustis, Va., where it probably is now.

The completed tests covered only about one-half of those planned. However, it was felt that a proper conclusion could be reached as to the value of this particular weapon as an accompanying gun.

The following deficiencies were noted as those to be avoided in building a suitable self-propelled accompanying gun:

1. Insufficient motor-power.
2. Insufficient speed.
3. Tracks too short and too narrow.
4. Tracks too easily broken.
5. Unit ground pressure too great.
6. Firing wedges or brakes too difficult to use.
7. Inability to pass through water of depths likely to be frequently encountered.
8. Necessity for stopping engine while firing.
9. Lack of electric starter.
10. Amount of fuel and oil carried too limited.
11. Positions of Gunner and No. 1, while firing, too strained and awkward.
12. Difficulty in depressing gun because of motor and radiator.
13. Traversing and elevating gear too slow and too limited.
14. Lack of ammunition chests.
15. Lack of caisson or ammunition carrier.
16. Lack of shield or bullet deflector for personnel.
17. Visibility, while firing, too great.

The following features of the gun under test were found to be advantageous:

1. Ability of S. P. gun to keep concealed while moving and while going into position.

2. Positive action of automatic breech-lock.
3. Better definition of panoramic sight.
4. Ability of Gunner to fire the piece.

As a result of this test, the officers of both the Infantry and the Field Artillery, who were making the test, arrived at the following opinions:

1. An accompanying weapon is definitely needed to support Infantry when and where Division Artillery is unable to do so.
2. Such a weapon must have great mobility, little visibility at all times, and at least 75 mm. fire-power capable of being instantly directed over a wide front. It must also afford good protection to itself and crew against small-arms fire.
3. A good accompanying gun should be capable of equalling the best Light Tank in high maneuverability and low visibility.
4. The gun just tested is not satisfactory due to its failure to meet the requirements enumerated above.
5. A self-propelled gun of proper construction will be faster and less vulnerable than any other type and is, therefore, most desirable.

In conclusion, the Infantry Board recommended that further tests be made of a pilot gun on a self-propelled mount and an ammunition carrier of like design so constructed as to approach the following requirements:

1. Chassis capable of mounting either a gun or of carrying ammunition so that the gun may be removed to the ground, if need be, and the chassis used to haul ammunition or the ammunition carrier used to transport the gun, thus making the two mounts interchangeable.
2. Ability to carry 50 rounds of ammunition on the gun mount and 200 rounds on the ammunition carrier which should also carry towing and repairing facilities.
3. Shields or bullet deflectors for protection of crew.
4. Mobility equal at all times to that of the supported troops whether on the march or in battle.
5. Visibility of the lowest possible order by keeping down the height of the gun above ground.
6. Vulnerability of the smallest degree obtainable by lightly armoring the vehicle and by placing the motor in the rear.
7. Fire power of 75 mm. calibre which is sufficient to stop a tank with a single hit at ranges up to 2,000 yards.
8. Ability to fire from the mount or from the ground and to go into and out of action at high speed.
9. Rapidity and accuracy of traverse and elevation sufficient to obtain effect upon armored vehicles moving at lateral or diagonal speeds up to 40 miles per hour.
10. High-powered and capable of crossing unaided any trench, ditch or other battle field obstacles and of climbing a slope of 1 on 1.
11. Provided with a water-proof ignition and carburetion system, or a high breather so that streams of medium depth may be crossed.
12. Capable of carrying enough gasoline and oil to provide for a march of at least 50 miles.

GEORGE LE ROY IRWIN

ON February 19, 1931, off the island of Trinidad, while returning from a futile effort to rebuild health shattered by years of active service, a distinguished Field Artilleryman passed away in the sixty-third year of his age.

George Le Roy Irwin was born a soldier at old Fort Wayne, Michigan. His gallant father, medical officer of the old school, won his Congressional Medal of Honor fighting hostile Chiricahua Indians in the Western wilderness of his day. To the son the militant qualities of the father descended. Graduating at West Point with the class of 1889, Irwin's entire service was identified with the arm which he loved so well, and in which he became a leading exponent. Creditable service in the Philippine Insurrection, with the Army of Cuban Pacification, and during the expedition to Vera Cruz, well prepared him for brilliant service during the World War. As commander of the 57th Field Artillery Brigade during the Marne-Aisne, Oise-Aisne, and Meuse-Argonne offensives, the citation of his Distinguished Service Medal paid him tribute: "At all times he displayed keen judgment, high military attainments, and loyal devotion to duty. The success of the division . . . was due in large measure to his technical skill and ability as an artillerist." France decorated him with the Legion of Honor and the Croix de Guerre.

He was commanding the Panama Canal Division as a Major-General when his untimely death came as a distinct shock to his legion of friends both within and without the military service. For his kindly interest in his fellow man was natural and spontaneous. His gift of leadership was maintained with minimum of effort. Outstanding ability as a soldier made him admired and respected in the highest degree, but the human sympathy which filled his heart to overflowing made him beloved by officer and soldier as one of nature's noblemen.

CHARLES D. RHODES,
Major-General, U. S. Army, Ret.

CURRENT FIELD ARTILLERY NOTES

F. A. Board Conducts Firing Tests of 75mm. Gun With T-2 and T-3 Mounts

Since early in March the Field Artillery Board has been testing the T2 and T3 mounts in conjunction with the Vickers director to determine their anti-aircraft as well as their terrestrial firing efficiency. The results of this test with both mounts have been eminently satisfactory.* The T3 mount was fired anti-aircraft from three positions, i.e. on the truck, on the bogie and on the ground. In addition a road test across the Fort Bragg range with the T3 mount on the truck, without the bogie, was held. The Vickers director was more acceptable for Field Artillery purposes than the larger Sperry director on account of its smaller size and weight.

The anti-aircraft firing tests came first and were conducted from positions on Vaughn Hill at Fort Bragg, whence the firing section available was 970 mils, less 123 mils. near the center which was eliminated in order not to damage Longstreet Church which is located in the middle of the sector. The sleeve target was towed in crossing courses at altitudes varying between 1500 and 2200 yards. An Air Corps officer acted as safety officer for the plane and a Field Artillery officer for the ground safety limits.

Prior to the tests of the T2 and T3 weapons, the Field Artillery Board tested the 3″ anti-aircraft weapon with Sperry director on fast moving ground targets. While the ballistic characteristics of the gun and the weight and size of the director were considered not satisfactory for division artillery purposes, nevertheless the results of these tests indicated the desirability of directing continuous fire against fast moving ground targets and opened the subject of the advisability of reorganization and equipment of division artillery to undertake anti-aircraft gun defense in addition to its present mission.

*These remarkable new types of all-purpose Field Artillery weapons were described at length in May-June, July-August and November-December, 1930, numbers of the FIELD ARTILLERY JOURNAL. The electrical fire control system which they use was described in the March-April, 1931, issue of this journal.

Mark I AA shrapnel with Mark III combination time fuzes was used. The muzzle velocity was approximately 2200 feet per second. It was remarkable that of 724 rounds fired during the anti-aircraft tests there were no duds and no erratic bursts.

The tests were conducted by Captain B. A. Day of the Board assisted by Lieutenant G. M. Taylor, O. D. The director, height finder, and gun crews were from Captain Buhl Moore's battery, Battery B, 5th F.A. Lieutenant R. T. J. Higgins was in charge of the gun section with Sergeant Frank Brantley as chief of section and Corporal Louis Bloom as gunner. The flank and axial observers and communications details were from Battery A, 1st Observation Battalion, in charge of Captain P. A. Reichel, assisted by 1st Lieutenant J. M. Work. These crews were the same which served the 3″ AA gun matériel a short time previously. They all worked energetically and loyally throughout the tests and succeeded in producing results which many, including Major G. M. Barnes, O.D., said they had not seen excelled in any anti-aircraft firing. General Bishop and General Brees witnessed a portion of the tests and both took the opportunity to compliment the officers and crews on the quality of their work.

Monday, March 16th and Monday, March 23rd were devoted to drill on the T2 and T3 mounts respectively, and to training the instrument, observer and communications details, including practice in tracking a plane. Tuesday, Wednesday and Thursday of each week were devoted to firing. The change of the tube, recuperator and equilibrators from the T2 mount required Friday, Saturday and Sunday morning (March 20, 21 and 22).

The following is a resumé of the firing:

Tuesday, March 17*—T2 Mount*.

A.M.—Seating shots and adjustment	—18	rounds
3 runs	—34	"
P.M.—Adjustment	— 5	"
Fired after difficulty with breech block	— 2	"
5 runs	—41	"

Some difficulty experienced in closing and opening the breech block; 6 shrapnel holes in sleeve in A.M., none in P.M.

Wednesday, March 18—*T2 Mount*.

A.M.—Seating shots and adjustment	— 9 rounds
5 runs	—63 "
P.M.—Adjustment	— 4 "
4 runs	—44 "

Target was shot down in the last run of the morning. Difficulty arose in the elevation electrical pointer getting out of step, but this was corrected. There were six shrapnel holes in the A.M. target and two in the P.M. target.

Thursday, March 19—*T2 Mount*.

A.M.—Adjustment	— 5 rounds
Correcting azimuth trouble	— 6 "
8 runs	—102 "

The azimuth pointer gave some trouble due to loose connections. There were 58 holes in the target.

Tuesday, March 24—*T3 Mount in all-round firing position on the ground*.

A.M.—Seating and adjustment	— 6 rounds
3 runs	—46 " —no hits
P.M.—Adjustment	— 3 "
7 runs	—99 " —one case hit, several shrapnel holes and tears.

Wednesday, March 25—*T3 Mount in all-round firing position on the ground*. (General Bishop was present for most of the firing)

A.M.—Adjustment	— 5 rounds
10 runs	—129 " —target shot down, 40 shrapnel holes.

(Gun was placed on the truck and maneuvered).

Thursday, March 25—*T3 Mount on truck in A.M.; in* 90° *firing position on bogie in P.M.*

A.M.—Adjustment and seating	— 6 rounds
4 runs	—61 "
1 case hit and 36 holes in sleeve	
P.M.—Adjustment and seating	— 6 rounds
2 runs	—30 "
Results not reported.	
Totals:—T2 Mount—333 rounds	
T3 " —391 "	
724 "	

The cause of the breech block trouble was discovered and corrected. The recoil oil was found to be too hot, and it was decided to limit the firing to 40 or 50 rounds at rapid rate, stopping thereafter for about 10 minutes to cool and swab out.

All firing was done with the same gun. This 75mm. gun, Model 1920, with its recoil mechanism was fired as shown above first on the T2 mount, then later from the T3 mount.

The greatest number of shots fired in any one course was 22. The highest rate of fire was a little better than 18 rounds per minute. The rate of fire was limited by the time consumed in loading, not by the design of the breech block. With greater

speed in loading, however, the breech block would become the limiting factor. The accepted rate for 3″ anti-aircraft firing is 25 rounds per minute. The breech block trouble noted above was caused by sheared fuze lugs falling into the breech mechanism.

Both mounts were decidedly satisfactory from the point of view of firing results. Major Barnes, O.D., who designed the T3 mount, stated that he believed these weapons to be sufficiently powerful and accurate for all Corps Artillery anti-aircraft missions and decidedly more mobile than the 3″ AA matériel.

Considerable thought is being given to the possibility of simplifying and lightening the fire control equipment. Major Barnes believes that a two-yard-base height finder, at least, will be required if anti-aircraft fire is involved. A five-meter-base coincident type height finder was used in the above tests. It would not have been satisfactory if the courses flown had been difficult. No stereoscopic height finder (the better type) was available.

After testing the anti-aircraft firing efficiency of the 75mm. gun on the T-2 and T-3 mounts, the Field Artillery Board, during the month of April, conducted firing tests against fast moving ground targets using the T-3 mount in conjunction with the Vickers director. The firing was exceedingly successful. The Vickers director was transformed from an anti-aircraft computer and transmitter to a ground target computer and transmitter by Lieutenant Taylor, O.D.

In the course of these terrestrial firing tests, during which the target was moved at speeds varying from 30 to 45 miles per hour over straight courses, courses with turns and zig-zag courses, the gun was fired from each of its three possible positions—on the truck, on the bogie and on the ground. The results were uniformly satisfactory.

New Artillery Range for West Point

A project dear to George Washington will take on final form with the addition of 15,000 acres of land to the reservation of the United States Military Academy at West Point, thus rounding

out the scope of the school as Washington desired it to be. The dedication of this additional land has been most appropriately set for next year, 1932, the two hundredth anniversary of Washington's birth.

Field Artillery instruction at the Military Academy will be greatly improved as a result of acquision of this new area which extends towards the west and inland from the inhabited parts of the post of West Point. The additional tract lies between the so-called Cadet Farm and the watershed.

Heretofore Field Artillery service firing at West Point was done in a very restricted area where it was not possible to fire at ranges much over 2600-3000 yards, as it was necessary for safety to fire against Crow's Nest. During the service practice seasons of 1929 and 1930 the cadets could not even use this area because firing there necessitated closing the Storm King road to automobile traffic, which in recent years has greatly increased in volume. During 1929 and 1930 the cadets had to do their Field Artillery service firing at Fort Eustis, Va. The new area is very conveniently located for the cadets and affords a fine maneuvering and firing range over rugged and varied terrain with excellent OP's.

Probably no military locality figured more often than West Point in Washington's mind during the War for Independence. He early had seen the importance of the Hudson river. Control of that waterway by the enemy would have cut the thirteen warring colonies in two. Command of the river by the patriots meant dominance of the military situation and was necessary to victory in the war. And West Point was the key position on the river.

In full appreciation of this fact, Kosciuszko was commissioned in 1778 to plan fortifications for West Point that would make it "the Gibraltar of the Hudson."

Washington, however, saw in West Point a utility to his army beyond its immediate strategic importance. None knew better than the Commanding General the scarcity of well-trained officers in his ranks, and the situation of West Point seems to

have impressed him even then as a good one for the establishment of the needed military school.

On Washington's recommendation, Congress appointed a committee to draw up plans for such a school and in 1777 a corps of officers not able to perform field service was organized in Philadelphia. In 1781 this body was sent to West Point "to serve as a military school for young gentlemen previously to their being appointed to marching regiments."

Congress had thus found time to act upon Washington's idea, and such were the beginnings of West Point. Three rough buildings had been erected to house a library, an engineers' school, and a laboratory. Preliminary practice in gunnery also was set up. That Washington had in mind the future development of West Point is shown by the fact that at Newburgh, in 1783, he laid before his generals further plans for a more extensive academy there for artillerists, engineers, and cadets. But not until after the war, when he was President, had he the time or the authority to give effect to his ideas.

In 1794, during his administration, he recommended to Congress the upbuilding of a school for thorough and complete military training at West Point. The school was not without its vicissitudes, however. A fire destroyed what Congress had already accomplished and the Academy, as it then was, was wiped out and forgotten for six years.

Still Washington's idea survived, and in 1802 President Jefferson took up the plan and rebuilt West Point. True to his own sense of the fitness of things, Jefferson saw to it that July Fourth should be the date of re-opening. On that day West Point as we know it today got down to its work with an enrolment of ten cadets. Since then nothing has impeded its work but cramped quarters and not always ample appropriations.

The Seventy-First Congress has authorized a move long indicated and urged, in order to carry out Washington's original purpose. General Washington had placed training in gunnery foremost in its teaching. At last, with 15,000 acres of additional land, the Academy is to have this needed artillery range, and also a training field for aviation. No one will question the fitness of

opening this new and larger West Point during the year when the Nation pays its homage to Washington.

Replacement of Unservicable Animals

Due to the increased demands to be expected from all sources for animal replacements in the future, officers in charge of organizations to which public animals are assigned, following this summer's training period, should put in requisitions for enough animals to complete their authorized allowances.

Looking toward the condemnation of unserviceable animals, the former War Department restrictions placed on the interpretation of Army Regulations pertaining to that subject have been withdrawn and the provisions of Army Regulations now obtain in their present wording. Such provisions allow the condemnation of a large number of animals whose period of economic utility has entirely passed.

March of Mechanized Force to Fort Bragg, North Carolina

The Mechanized Force at Fort Eustis, Va., will start on its first practice march on May 13th.

On its march to Fort Bragg, N. C., of about 300 miles, the column will pass through:

Denbigh, Driver, and Suffolk, Va.; Corapeake, Sunbury, Doduco, Winton, Murfreesboro, Conway, Jackson, Weldon, Littleton, Macon, Norlina, Middleburg, Henderson, Kittrell, Franklinton, Youngsville, Wake Forest, Raleigh, Cary, Apex, Newhill, Moncure, Sanford, Jonesboro, Swann, Olivia, Spout Springs, and Manchester, N. C.

The Force consists of 35 officers, 630 enlisted men with 150 motor vehicles of standard and experimental types.

The column will camp at Jackson, N. C., on May 13th and at Raleigh on May 14th.

The purposes of this march will be:

To test the mechanical sufficiency of its equipment;

To determine rates of march and to test means of control of its several columns;

To test its organization;

To test means of march security;

To determine requirements of individual equipment;

To determine radius of action and fuel supply of its several types of vehicles; and

In general, to give it the shaking down of a period of field service.

The Field Artillery Field Manual

This manual, which will appear in two volumes, was completed some months ago, but it became necessary to review it in conjunction with the special texts being issued simultaneously at the Field Artillery School, and also to incorporate changes incident to recent changes in tables of organization. Volume I has been completed in every way and is now at the Government Printing Office. Volume II will be there shortly. It is expected that both volumes will be issued this summer.

75mm. Pack Howitzer As An Accompanying Gun

The following policy on the subject of the development of an accompanying gun was approved April 22, 1926:

"The Chief of Field Artillery favors in principle the development of a Field Artillery accompanying gun. But he believes this gun or howitzer will have many of the characteristics of the pack gun now being developed. In view of this fact, and the further one that the Field Artillery is, even without the accompanying gun, faced with a heavy development program, every item of which is more important than the accompanying gun, and the difficulty of securing funds to carry on such development, the Chief of Field Artillery is opposed, at the present time, to developing a special type of such gun, and recommends that the matter be left in abeyance until the latest pack howitzer has been supplied; and after this weapon has proved satisfactory as pack artillery, it should then be tested as to suitability as an accompanying gun."

In view of the fact that since this policy was announced the 75mm. pack howitzer has been developed, thoroughly tested, standardized and issued, the time has now come to determine its suitability as an accompanying gun. Therefore the Chief of Field Artillery has directed that a 75mm. pack howitzer M-1 with draft equipment be sent to the Field Artillery Board for

test to determine its suitability in this respect. One Infantry cart M-2 is also being furnished to determine its suitability for transporting ammunition and other necessary cargo with the accompanying gun. A 1¼-ton 4-wheel drive truck will also be made available to the Field Artillery Board for test as a means of transporting the howitzer's ammunition and cargo.

In the conduct of these tests the following considerations with regard to the mission and tactical employment of the gun will be borne in mind:

The weapon must accompany the dismounted Infantryman as closely as possible in the attack for the purpose of breaking up unforeseen resistance which the Infantry is unable to overcome. It is considered that a cannon suitable to physically accompany tanks in the attack would probably have characteristics as regards armor protection and means of transport very different from the accompanying gun contemplated.

The principal targets for the accompanying gun will be machine gun nests, Infantry mortars, accompanying guns, antitank guns, and in some instances enemy personnel. While fast-moving tanks and armored cars are considered to be exceptional targets for an accompanying gun as distinguished from an antitank gun, nevertheless it is desirable to determine in this test the capability of the pack howitzer for firing at such targets.

The following additional tests by the Board are contemplated in connection with the accompanying gun:

The 75mm. Pack Howitzer mounted on a motor carriage (Track Development Chassis) which is now in the hands of the Mechanized Force, will be furnished the Field Artillery Board for test as an accompanying gun as soon as it can be made available for the purpose.

A Citron-Kegresse tractor has been purchased for test for the Field Artillery Board. This vehicle may prove satisfactory as a means of transport of an accompanying gun, its ammunition and other cargo.

Steps have been initiated for the purchase of a Stoke-Brandt 81mm. mortar and ammunition for same to be tested by the Board to determine its suitability for use by the Field Artillery as an accompanying gun.

As an animal drawn accompanying gun, the 75mm. pack howitzer will be tested drawn by two mules in tandem.

T1 155mm. Howitzer

This weapon weighing 14,300 pounds in firing position and having a maximum range of 16,390 yards, is being tested by the Field Artillery Board after top-carriage modifications and changes in wheel closures have been made, enabling it to travel from 20 to 35 miles per hour on good roads. Road and cross-country mobility tests and firing tests will be conducted.

Cargo Carts, T5 and T6

These cargo carts were developed to take the place of caissons and caisson limbers in 75mm., 105mm. and 155mm. howitzer matériel, due to the fact that an ammunition vehicle which carries the rounds in diaphragms built into the vehicle cannot meet the requirements of the changes which are being made and which will probably continue to be made in the size and shape of the various projectiles. For instance, the present 75mm. caisson cannot satisfactorily carry the Mark IV shell and cannot carry at all the latest type 75mm. ammunition, with shrapnel, or shell. This will require either remodeling all the caissons and limbers or building new diaphragmed vehicles which would again present the same difficulty for future changes in the ammunition.

In addition, for the 105mm. and 155mm. howitzer matériels a diaphragmed caisson will carry only about one-half as much ammunition as the T5 or T6 cargo carts. The 155mm. howitzer caisson carries 14 complete rounds whereas one cargo cart will carry 28 complete rounds.

Both of these cargo carts are two-wheeled vehicles of the trailer type with a wooden box cargo body four feet nine and three-quarter inches long, three feet ten inches wide and two feet one and one-quarter inches deep mounted on an under carriage which in turn is mounted on an axle. The axle is mounted on 56-inch wheels, slightly heavier than 75mm. artillery wheels. The width of tread is the same as that of the 75mm. matériel. The T5 cart is identical with the T6 cart except that the latter has external contracting drum breaks operated by a hand lever,

and that the former has an automatic pole support on its pintle. When the two vehicles are coupled together for horse-drawn traction, the T5 is used as the limber and the T6 as the trailed vehicle. The T5 may be either equipped with a pole for animal draft or a draw bar for tractor draft. The weight of these carts empty is: T5, 1325 pounds; T6, 1415 pounds.

The test of these carts is now being conducted by the Field Artillery Board and to date the carts have been used for carrying 75mm. ammunition boxes and by individual rounds in fibre containers, and 155mm. howitzer ammunition with the projectiles loose and the charges in the prescribed containers in boxes. The T6 cart has also been used as a ration cart behind the experimental water carts.

The tests to date indicate that in general these cargo carts will be satisfactory as ammunition carrying vehicles for 75mm., 105mm., and 155mm. howitzer matériel.

Fast Moving Targets for the Field Artillery

While the Field Artillery has always had service practice at moving targets, such practice in the past has been at targets moving at not over ten miles per hour.

Inasmuch as targets such as tanks and armored cars, having a speed up to 35 miles per hour, may be expected on future battlefields, it is manifest that the Field Artillery must be prepared to attack such fast moving vehicles and must train accordingly.

The problem of devising a target capable of such speed was recently assigned the Field Artillery Board at Fort Bragg, N. C.

The requirements were speed up to 30 or 40 miles per hour, with changes of direction, cheap and simple construction, and of such a nature that it could be used over the varying terrain of the different Field Artillery posts. Additional requirements of the Board were to determine the suitability of existing Field Artillery matériel for the handling of such speedy fire, and to determine appropriate commands and methods incident to such fire.

The Board has received and tried out many suggestions from the service as to types of targets, including a revolving platform

for the gun with a fixed target; gravity run targets on tracks and trolleys; controlled motor targets, and various types of sled targets.

As is frequently the case, the Board has found that one of the simplest suggestions is giving the greater promise—this consists of a sled or toboggan about 10 feet long, made of ordinary light galvanized iron, such as roofing iron, carrying a mast with a streamer. The lightness of this target permits it to be towed with ordinary telegraph wire, using a Ford car as the motive element, and traveling over an ordinary country road whose only preparation was to smooth out ruts and remove snags. A speed of 40 miles per hour without overturning or snagging the target has been obtained. An ingenious apparatus, which consists principally of a salvaged bicycle wheel, has been devised and gives great promise of affecting changes in direction without overturning the target.

All matériel and ammunition for the test has now been received by the Board, including the new 75mm. Pack Howitzer, and the Board is now prepared to continue tests along the lines of the other requirements.

Gliders

Two obsolete Air Corps gliders have arrived at Fort Bragg for use as targets for anti-aircraft firing. The Field Artillery Board is experimenting with their possibilities, but to date actual fire has not been directed upon them. One of the gliders stayed up in the air 25 minutes, but it was difficult to make the glider keep in the safety sector.

Sea Going Pigeons

Recently two Signal Corps homing pigeons were placed on the *S. S. Leviathan* and made the journey to England and upon the return of this ship were released approximately 100 miles from New York. One of these birds, "Dox," homed to Fort Monmouth in good time, but the other pigeon, "Uncle Sam" refused to leave the ship and after several tosses he was allowed to settle and was brought on to New York. Since homing pigeons can not

take off from the surface of a body of water, they naturally have a strong aversion to flights of any distance over water and, therefore, the performance of "Dox" is remarkable.

"Talkie" Training Films

The Signal Corps contemplates the production of "sound" training films in addition to the silent types which have heretofore been produced. The necessary recording and reproducing equipment has now been installed, and within several months actual production will be undertaken.

The recording studio is located in the Munitions Building, Washington, D. C., in what was formerly the projection room and library. This room has been insulated and soundproofed, and preliminary tests indicate that it is a most satisfactory studio for its purpose.

The equipment installed consists of a sound-projection apparatus and a sound-recording set arranged to operate independently of each other or in absolute synchronism. The installation was made and equipment furnished by the R. C. A. Photophone Corporation. It is of the latest design and embodies the most advanced ideas in sound recording.

The present plans contemplate the scoring of lectures on training films and not the recording of all incidental sounds as they occur during the action. Later, perhaps, the necessary equipment may be obtained to add this latter feature to the films as well. The complete training films, under the proposed method, will be of the nature of a silent picture with a synchronized lecture, somewhat similar to the news reel which has a talking reporter describe the news events as they appear on the screen. A distinct advantage of this type of sound film is the absolute control of the application of the lecture under conditions most suitable for this purpose.

River Crossing Tests

Motor driven pontoon rafts for ferrying light artillery across streams or in sea-coast landings were recently subjected to initial service tests in ferrying operations at Fort Hoyle, Maryland.

Outboard motors were used to propel the rafts, which were loaded with both motor and horse drawn artillery with full

equipment. New aluminum pontoons, latest design of the Corps of Engineers for bridging operations, were also included in the equipment tested.

As an added tactical feature, the concluding demonstration was conducted under the smoke screen laid down by the First Chemical Regiment from Edgewood Arsenal using smoke candles from small boats, reinforced by a smoke-laying airplane. A prevailing high wind, however, quickly dissipated the smoke screen.

Ferrying operations were handled by Company C, 1st Engineers, from Fort Dupont, Delaware, with Batteries C (motorized) and F (horse) of the 6th Field Artillery from Fort Hoyle, Maryland. The ferrying was done over the Gunpowder River, near Fort Hoyle.

The rafts consisted of three standard heavy type pontoons lashed together and overlaid with flooring with outboard motors attached to the rear of the center pontoon. The light pontoons with duralumin frames and gunwales and an aluminum skin were used in laying a 100-foot approach ramp with a hinged joint connecting the rafts.

It was found easy to accommodate two sections of *motorized* artillery consisting of two tractors, two caissons and two guns, or one *horse-drawn* section of one gun, one caisson, two limbers and thirteen horses. For the two motor-drawn sections the total load was 31,000 pounds and for the horse drawn section 30,000 pounds. Outboard motors provided dependable speed and control, despite the heavy wind and rough water. Officers timing the loading gave 10 minutes as the maximum required to embark a pontoon load. The speed of the raft was estimated at three or four miles per hour.

The operations were conducted under the supervision of Brigadier General James B. Gowen, commanding the 1st Field Artillery Brigade. Among those witnessing the tests were: Major General Fred W. Sladen, commanding the Third Corps Area; Major General Harry G. Bishop, Chief of Field Artillery; Brigadier General Edward L. King, Assistant Chief of Staff G-3, War Department; Col. Laurin L. Lawson, 6th Field Artillery, and the entire class from the Engineers' School, Fort Humphreys, Va.